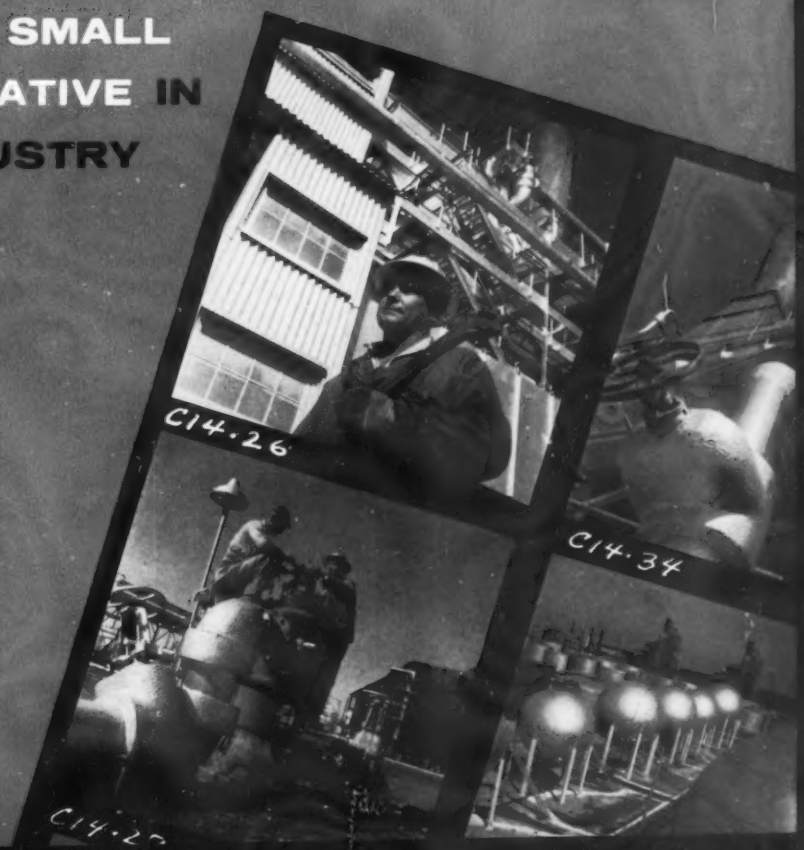
PMI

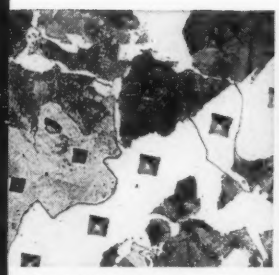
PHOTO METHODS FOR INDUSTRY

VOL. 1. NO. 4
APRIL
1958
PRICE 50¢

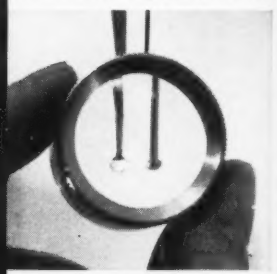
THE SMALL NEGATIVE IN INDUSTRY



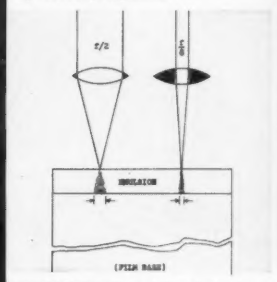
VERSATILE
TOOL FOR INDUSTRY



PHOTOMICROGRAPHY—Steel surface greatly magnified through LEITZ microscope, recorded by LEICA. Diamond impressions made by LEITZ tester indicate degrees of hardness.



MACRO PHOTOGRAPHY—Common pin and an unfinished micro-optic under magnifier, photographed with LEICA, lens extension and VISOFLEX. Photo by Liesel Springmann.



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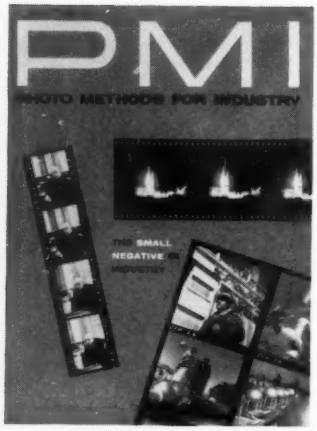

top, Flight Research Inc., see page 63
left, Morris Gordon, Western Electric Co.
bottom, Fritz Henle, Cities Service

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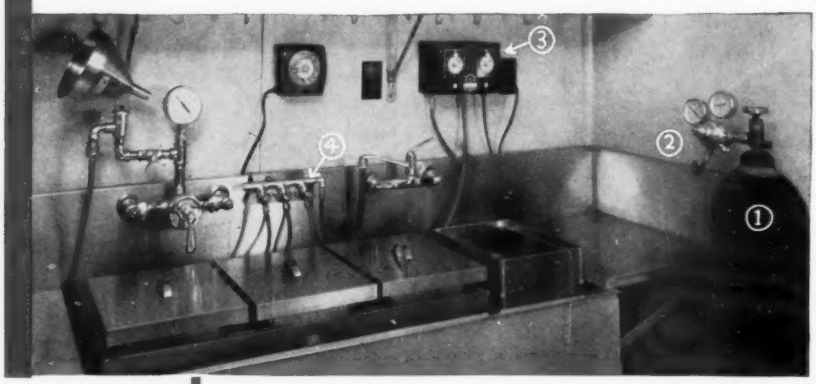

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LETTERS

To the Editor:

I wish to take this opportunity to congratulate you and your staff on PMI. My first copy (Vol. 1 No. 3) was delivered to me this last weekend.

The subject matter appeared well presented and adequately covered.

After reading the issue, my curiosity was piqued as to what the two previous numbers had contained. I would appreciate having the two back numbers.

L. T. Pimental
Rockville, Md.

Sorry, first two issues sold out. Ed.

To the Editor:

I enjoy immensely Lloyd Varden's articles in PMI . . . I was particularly pleased to read "The Graphs No One Knows How to Read" in the March PMI . . .

I have been studying the H & D curve myself for some time, and have found a great lack of material available to connect its theoretical aspects with the practical side. Varden's article certainly was a big help in this respect.

I have recently constructed my own curves for various materials with UFG as developer. I used a Retina IIIc with its equivalent shutter speed-f/stop scale to make the exposures, and processed the film under the best conditions possible. Although there was undoubtedly much experimental error, the curves obtained were quite smooth. For some reason, however, my gamma values obtained for UFG were quite a bit lower than the manufacturer claimed, but not too far away from the D-76 values. I haven't been able to determine the reason thus far . . .

Thank you again for Varden's excellent articles.

David W. Moore
Chicago, Ill.

To the Editor:

I read with interest your article "Explosion Hazardous Situations" in the March issue of PMI . . . would let me have the address of Photo Lectronic Research Co. and Wilmot Castle Co. whom you mentioned in this article.

Fred Hartman
Chicago, Ill.

Photo Lectronic Research Co., 141 W. 42nd St., New York, N. Y. Wilmot Castle Co., P. O. Box 629 Rochester, N. Y.

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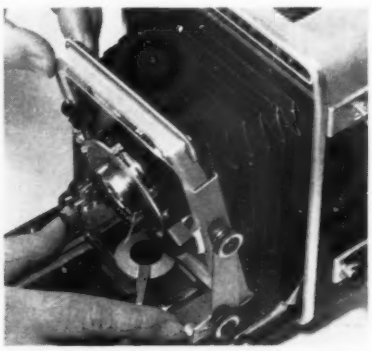
Get more information. Circle 424, page 59

Flexibility of all movements to adjust composition and depth of field. Front lens standard tilts forward and back, swings right and left, rises and shifts right and left.

Forward tilting lensboard and drop bed combine for 30° tilt. Increases apparent depth of field when taking pictures from a balcony, down a flight of stairs or in similar situations. Drop bed also accommodates wide angle lenses.

Lateral swing increases apparent depth of field when photographing some types of subjects. Can be used in combination with all other tilts, swings and shifts to correct optical distortion, parallelism and composition.



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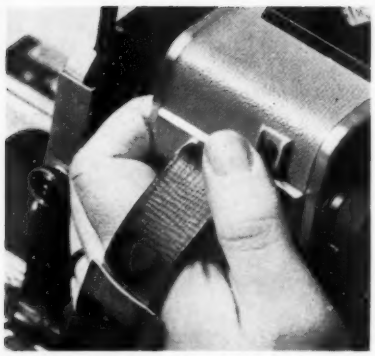
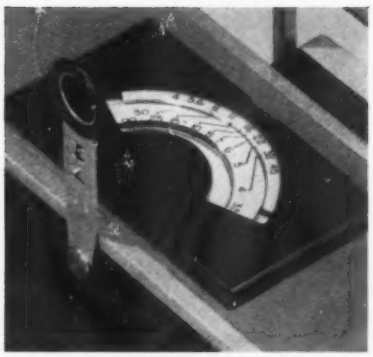
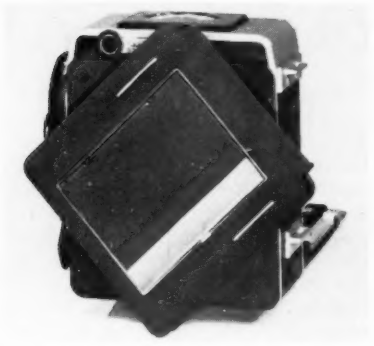


Electric shutter and flash tripping from button located conveniently to operate built-in BC circuit with self-contained batteries. With Graflite and Stroboflash accessories you trip electrically with either hand, at the camera or remotely.

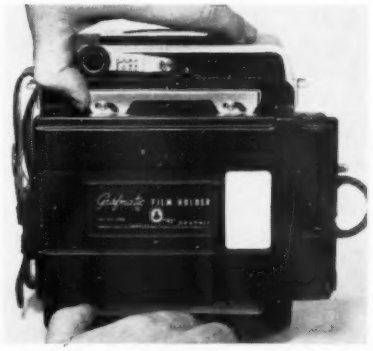
Interchangeable cams to match any lens operate integral rangefinder, focusing scale and flash exposure calculator. Cams are individually cut to match your lens characteristics. Slip in and out of position in a second.



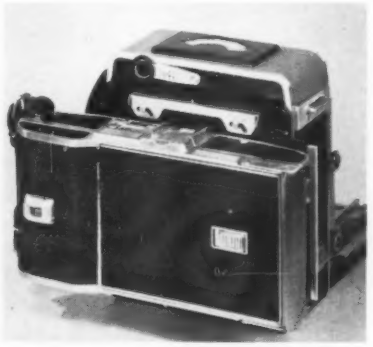
Automatic focusing scale is located conveniently on top of the camera. This one scale matches any lens you use on the camera. Combines with flash exposure calculator; just set dial for guide number, focus camera and read correct aperture setting indicated by pointer.



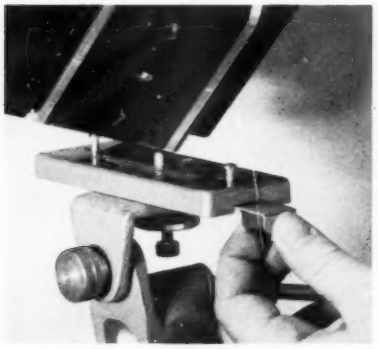
Revolving back for horizontal and vertical positions. Permits film holders to be inserted from top, bottom, right or left—a real convenience for many lefthanded photographers (also, hand strap and flash attach to either side of camera).



New style double cam action slide lock holds any accessory for Graphic or Graflok back. Slide off focusing panel and attach Grafmatic sheet film magazine, Roll Film Holder, Film Pack Adapter, Polaroid Back or Graflarger. Accessories become part of the revolving back.



Use any type of film—black and white or color. Super Graphic accessories accept single sheets, film packs, 120 rolls and Polaroid (60-second) films. You can even use coated glass plates for scientific research requiring superfine grain or unusual light sensitivity.



Presslok Tripod Mount (accessory) fits any tripod and can be left permanently attached. Twin keyhole locks provide for instantaneous, fumble-free mounting of Super Graphic camera. Assures rigidity. Camera cannot be accidentally released.

Wide angle, normal and most telephoto lenses in shutter combinations suitable for a 4x5 camera can be mounted on a Super Graphic lensboard assembly. This assembly includes all internal connections for flash synchronization and electric shutter tripping. Lock lensboard in place and all connections are complete.

Three-prong, polarized flash connector cords plug into the camera body. There are no dangling wires on the lens standard which can obstruct the lens or rangefinder. The camera can be opened and closed without disconnecting the flash.

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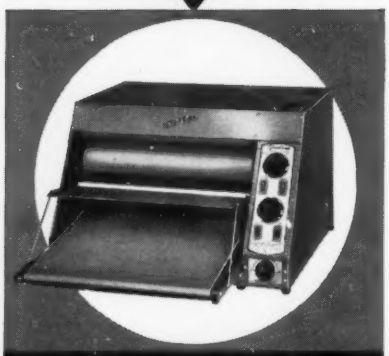

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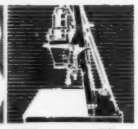


Get more information. Circle 405, page 59

F.Y.I.

The Mole-Richardson Co. is now going in for enlightenment as well as lighting. As a feature of their display room at 937 North Sycamore Ave., Hollywood, Calif., they are setting up a library which they intend to be the finest collection of reference works on all subjects relating to motion pictures, still photography and TV. "This library," says E. C. Palmer, Executive Vice-President, "will not be limited to Mole-Richardson Co.'s principal interest—that of lighting—but will cover every subject of a photographic nature."

Free films

Add to things we never knew till now: The Bureau of Mines of the U. S. Department of the Interior has a film library of over 6000 prints, all 16mm sound and almost all in color, on 58 different subjects relating to conservation and development of mineral resources. Nationally distributed on a free loan basis, the films are sponsored and underwritten financially by private firms, but contain no advertising. Last year they were seen by 32,000,000 people at private showings and on non-commercial TV programs.

Most popular film: Richfield Oil's *California and Its Natural Resources;* runner-up, Union Carbide's *The Petrified River.*

Main distributing point is the Bureau's Central Experiment Station, in Pittsburgh.

Egghead photogs

Anyone who can stand Washington in August and is interested in photography in the natural sciences ought to try to make the annual meeting of the Biological Photographic Association, at the Shoreham Hotel from Aug. 18 to 21.

Highlighting the program will be an all-day session at the Walter Reed Army Institute of Research, for a display of the latest techniques employed by the Medical Audio-Visual Department of this world famous research institution. The Scientific Salon will feature a display of award winning transparencies, prints and motion pictures. All representatives of the photographic, medical and scientific professions are invited.

Strong on art?

A ten-day Pan-American Luxury Flight to Spain for two, heads the list of prizes in this year's worldwide $5000 Coloring Contest, run by the John G. Marshall Mfg. Co., makers of Marshall's Photo-Oil Colors and Marshall's Photo-Oil Pencils. The contest runs until July 31, and any photo, Polaroid Land print, picture, or drawing colored with the Marshall products is eligible.

If you don't get the trip to Spain, there are dozens of other prizes—equipment, photo courses, subscriptions to photographic and art magazines—for lesser winners.

Taxes made easy

Accountant work in pencil? Take ages copying tax returns in ink? Make mistakes in transcribing? Tax time used to be a time of deep gloom in many offices. Now the U. S. Internal Revenue Service has authorized the submission of legible photocopy reproductions of tax forms and schedules under certain circumstances, even though the original be made out in pencil. Checks must still be made out in ink, though. (Copease Corp. has more information on photocopying tax forms; just circle 201 on the Readers' Service Card, *page* 59.)

Off the beam

Lloyd Varden points out some sins against chemistry in our item last month concerning Beseler's Slide-O-Film. To set the record straight: the light-sensitive layer of this material is not an emulsion; it's free of both silver halides *and* silver nitrate, and though it is capable of high-resolution copies, they aren't necessarily higher-resolution copies than those obtainable with other materials.

In our own defense we can only mutter that we still think it's pretty fascinating stuff. THE END

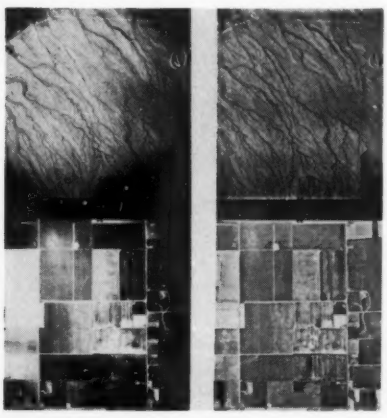
by LLOYD E. VARDEN

PHOTO METHODS FOR TOMORROW

Phototubes determine print exposure, contrast and dodging

During a recent discussion with Dwin R. Craig and Gordon O. F. Johnson of LogEtronics Inc., they brought me up to date on the new equipment their company has perfected and soon will introduce. In case you are not familiar with the principle of the LogEtronic printer, it can be thought of as an exposure control and dodging system, electronically varied according to the requirements of each negative. A spot of light scanning across the surface of a cathode-ray tube is used for exposure, but the intensity of the light spot is adjusted by an inverse feedback dependent upon the densities within the negative itself. Thus, the exposure received by the printing paper is varied locally, allowing detail to be retained throughout, regardless of the contrast characteristics of the negative.

In the LogEtronics printer introduced a few years ago, the negatives had to be exposed in a stationary position. Now a new, continuous



Usual contacts vs. LogEtronics'

contact strip printer is being readied for release, called Model SP 10/70. It will handle rolls of film up to 400 feet long and 70mm, 5¼ inches or 9½ inches wide. The transport speed is continuously variable up to 40 feet per minute. At a typical printing speed of 25 feet per minute for 9-inch aerial film, this means that 30 prints per minute can be exposed. And the resolution obtainable has now been made better than 45 lines per millimeter by means of special mechanical innovations that eliminate resolution losses due to poor tracking.

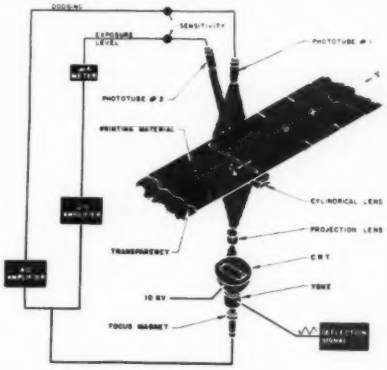


Figure 1.

The operation of the machine can be seen from Figure 1. The light source is a simple line scan on the surface of the cathode-ray tube (C.R.T.), and the other axis of scanning is provided by the motion of the film and paper materials as they are transported across the slit exposure aperture. The dodging phototube drives an AC-coupled feedback loop to control and modulate the intensity of light within the scanning slit. A second phototube feeds back a DC signal to the cathode-ray tube to maintain the overall constant light level required for proper exposure at the particular transport speed selected.

Obviously this type of equipment pays off when an industry has a high volume of critical photographic printing, despite the $17,425 price. But firms having a relatively small

(continued on page 52)

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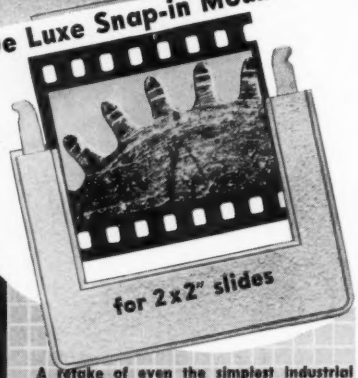

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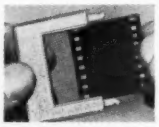
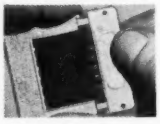


STEP 1—INSERT



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by Ernest E. Reshovsky

PHOTO INSTRUMENTATION

Of lenses on cameras, or as they say today, of cameras on lenses

The accompanying photograph isn't very sharp and the grain in it is slightly above the level that would be tolerated in a wedding candid, but it's a technical triumph anyhow. John Keller, a member of the Technical Staff of the Sandia Corporation, which made the picture, revealed a few of the startling details of the feat.

The subject is a Chance-Vought Regulus I missile, made for the Navy, undergoing a drop test at Salton Sea, Calif. The camera—a Mitchell—was well over three miles from the missile when the shutter opened. If the office wiseacre thinks he could do as well with his pocket snap-shooting rig, let him try. But unless he gets the sound barrier building up in front of the missile, the picture doesn't count!

The Sandia Corporation is an ordnance research and development organization that operates test bases for missile and rocket research at Salton Sea, Calif., and Tonopah, Nev. Though not primarily interested in photo instrumentation, the nature of their work is such that Sandia finds itself one of the leading users of long focal length telescopic lenses in the country and pioneers in the design of vibrationless, flexible, fast-action mounts for an assortment of high speed and cine cameras and their lenses.

These mounts are generally revamped machine gun turrets or large gun mounts. The improvements and modifications have been carried out in Sandia's own shops. Their MC-12 turret, for example, is basically an M-45 gun mount which Sandia has modified with new bearings and a complete new hydraulic drive and tracking system.

Regulus I and shock wave—three miles from camera.

"At one side of the turret," says Keller, "we've mounted two 40-in. focal length refractor lenses and their 35mm high speed frame and streak cameras, which usually run in excess of 1000 frames per second. On the other side of the turret there is a 60-in. prime focal length reflector telescope with a parabolic mirror 12 in. in diameter. The focal length of this telescope can be increased as needed to 120, 180 and 240-in. by means of an amplifying lens system."

An "amplifying lens system," the term is unfamiliar, is merely an electronic engineer's name for what photographers have known for years as a set of supplementary lenses.

"On this lens we've mounted a 35mm Mitchell cine camera which operates at 48 or 96 frames per second," added Keller.

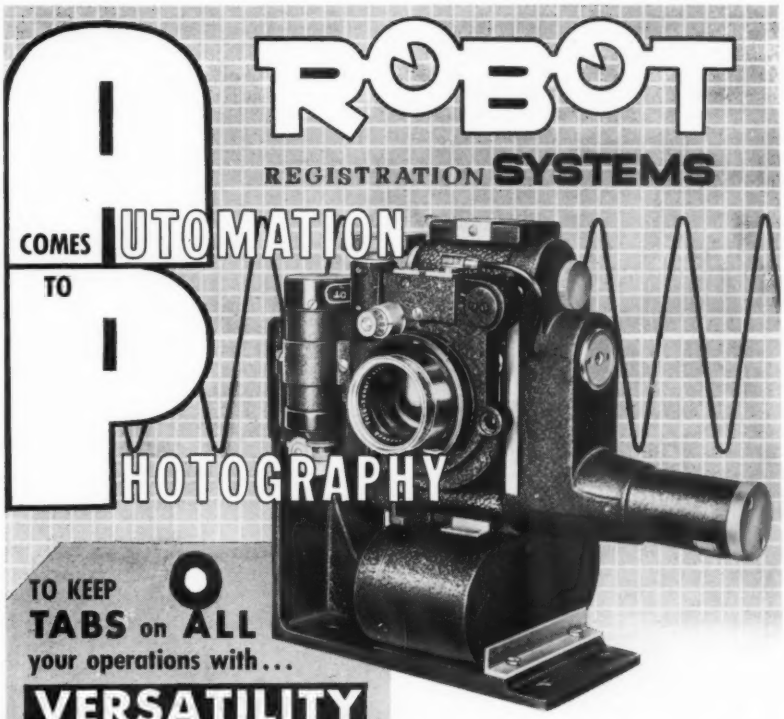
"The MC-12 is not the largest turret and lens system used on the ranges. Some are built around modified gun mounts and have telescopic lenses using 16-in. and 24-in. diameter primary mirrors. These turrets offer great stability and the lens systems are capable of high speeds and resolving power. Some of the long focal length telescopic lenses Sandia uses are capable of taking a picture of a man two miles away in such detail that when you blow up the print you can recognize him! In fact, the lens systems used by Sandia are so long that they customarily speak of a 35mm Mitchell mounted on a lens, rather than vice-versa.

"Astro-dome shelters, that look like the ones used in observatories—no reason why they shouldn't, since they do the same job—protect the turrets and allow their operation during inclement weather. These shelters usually are located 20 feet or more above the surrounding area, either atop concrete buildings or on concrete slabs on hilltops, to minimize the effects of such ground disturbances as heat and dust.

"These turrets are operated by one man who tracks optically, using an aircraft-type control stick to regulate the rate of azimuth and elevation movement. Most turrets can also be "slaved" to a tracking radar for early target acquisition. Skilled operators can track planes and bombs far beyond the range of unaided vision. Pictures taken at ranges of eight and ten miles show remarkable detail, and usable pictures have been made from further away.

"Of course," adds Keller, "the turret isn't the whole story by any means. Important to the quality of the long range images are the aids

(continued on page 55)



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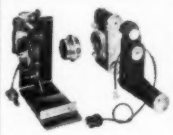

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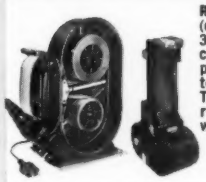

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by Edward R. Farber

ELECTRONIC FLASH

Keep your slaves slaving away—directions for quelling revolts

Most professional electronic flash units can be used as photo-electrically controlled slave units. Those types which feature trigger tube triggering require only the addition of the phototube itself. Others need the addition of a complete control circuit, which is somewhat more expensive.

The elimination of wires, either for AC power or for tripping is, of course, a boon to the industrial photographer, permitting almost unlimited placement of the lights. The new Heiland 60S slave puts reflector and power pack into one package and eliminates even the external reflector-to-pack cord.

The secret of successful slave shooting depends on proper illumination of the phototube (not as simple as it sounds) and equipment kept in top condition.

Phototubes used in flash units are really nothing but variable resistors whose resistance decreases in proportion to the light falling on the sensitive surface of the tube, thus permitting small currents to flow in that same proportion.

Since these currents are so small, it's most necessary to keep all connections electrically perfect. Connections between phototube and trigger tube must be clean and make good contact. Insulations must be clean and dry. Any leakage of the current will result in self flashing or failure to flash. Condensation caused when cold equipment is brought into a humid room, or continued high humidity weather can be disastrous. (Ordinary insulations absorb moisture just like wood.)

Best protection is to make certain that all parts are clean and dry (warm in oven if necessary) and then coat with a silicone grease or lacquer.

All electrical connections of phototube and trigger tube circuits should always be made with rosin for flux when solder is used. Almost every other kind of flux leaves an acid or alkaline deposit which is conductive when moist. This cannot be removed with ordinary solvents and actually penetrates the insulations. Use only rosin core solder and be sure.

6 tips on slave shooting

Even when equipment is in perfect condition, large area phototube tripping requires the same skill in "exposing" the phototube as in exposing the film:

1. **Aiming and Placement:** It is not usually enough that the phototube "see" the master or tripping light. A very definite amount of light must reach the phototube and frequently the few rays of spill from the side of a reflector are not enough to do the job. Much more total light will frequently be bounced back from the subject. This is only logical since the camera lens must "see" a certain amount of illuminated *area* in order to expose the film. Thus aiming the phototube at the subject is often the better solution.

Sometimes it will be necessary to put the phototube on the end of an extension cord. (Observe proper polarity—some circuits will trip when connected either way, but with reversed connections lamp will fire on the decrease in intensity of the master light and thus will not be in sync with the master.)

2. **Special Trip Lights:** Sometimes it's necessary to plug in an extension or sacrifice the illumination of an entire power pack to facilitate proper tripping.

3. **Sequence Tripping:** One pack can trip the nearest which trips the next and so on around the room as far as your power packs will last.

4. **Shielding from Extraneous Light:** Since intense light of any kind causes the phototube to respond, it's important to shield the tube's sensitive surface from direct sunlight, spotlights, or when in close

proximity to standard light sources. You can make simple shields of black paper or cardboard mailing tubes, which permit the "eye" to see the speed-light but not stray light.

5. **Caution:** Use enough watt seconds to get reliable triggering. The smallest units aren't always enough.

6. **Caution II:** Avoid exposing sensitive surface to direct sunlight. It may temporarily or permanently damage the tube.

Dry battery units and some of the new transistor units are most suited to phototube tripping since they can be turned on and put in place and left for hours without running down the batteries.

In some cases lighting equipment has been put in place and left on all day. Thus installation and removal of the equipment would not interfere with production.

Get that bounce

Although they like to use bounce light, many photographers complain that they cannot calculate bounce exposures. A good method is to calculate the distance from the light source to the reflecting or bounce surface and back to the subject. Use this for the lamp-to-subject distance to divide into the guide number you usually use for direct shots. Then, if the ceiling is white, open up two more stops. If it is a medium tone, open up four stops. When in doubt, open up.

Remember, as GE's Don Mohler says, "it's almost impossible to overexpose a bounce light shot."

Bounce lighting is a most useful way to obtain a soft fill light, but also can provide considerable modeling. When planning the lighting, remember that your light source (as far as the subject is concerned) is an illuminated patch on the ceiling (or elsewhere). The location of that patch in relation to the subject determines the modeling.

Also, the closer the bounce light source is to the ceiling, the sharper the shadows. Thus bounce permits much control with simple equipment. Of course, there are such tricks as bouncing into white umbrellas or onto white shirt fronts.

Milt Freier, Leica Press Technical Representative makes this illuminating suggestion: "Try taping a piece of tin foil around part of your strobe reflector so that when you aim the reflector to the ceiling, the tin foil is automatically aimed at the subject. What happens is this: The main portion of the light will bounce from the ceiling while just enough light to open the shadows under the eyes will be reflected from the foil."

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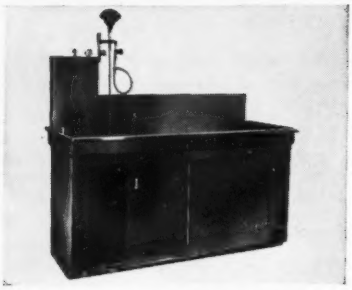

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by Samuel Lang & Leonard Zoref

INDUSTRIAL COLOR

Color computer cuts costly trial and error out of Type C printing

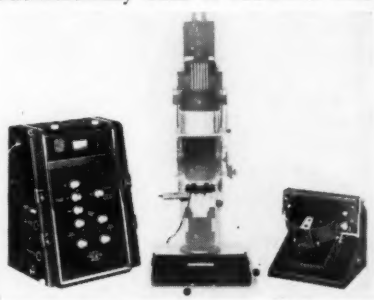
An ingenious device for exposing Kodak Color Print Material Type C is the Simmon Brothers' Omega Tri-Color Computer. The system contains six units that reduce printing color negatives on Type C paper practically to a science. Included are a computer timer, an automatic four position filter wheel, a photoelectric cell exposure meter, a color comparator, a voltage stabilizer and a test easel.

The computer has two sections, one for color balance and one for exposure (in terms of density). The color balance section contains eight variable controls. The first three are used in establishing the ratio of red, blue and green exposures from a known gray negative (supplied by Simmon) for the emulsion batch you are currently working with. These three controls normally stay constant until you start working with a new emulsion batch.

Changes balance, keeps density

The fourth control has five positions: tungsten, flash, daylight, strobe and off, which is used for color negatives originally exposed with filtration recommended by Eastman Kodak. This control adjusts the ratio of red, blue and green exposures—without altering the total exposure. Thus no density change occurs. If a completely unknown negative is used, four trial color balance exposures can be made on one piece of paper by means of a handy four-way easel. One of these test prints is usually in close approximation to the correct balance. The next four color balance controls do not come into play until the test is judged and the final print is ready to be exposed.

The second section of the computer calculates exposure. Its first stage consists of a barrier-layer photoelectric cell which is swung underneath the lens for an integrated light level reading. Another control in this section is the enlargement compensator. As the enlarger is raised the exposure is increased following the law of inverse squares. The diameter of enlargement is fed into the computer by setting a scale. This automatically adds or subtracts time



Omega Tri-Color Computer: *from left,* computer, easel, photocell, comparator

to the fixed red, green and blue exposure ratio. There are controls to vary the sensitivity of the photoelectric cell for various size negatives and to change print density.

Inside the machine is another control, which compensates for reciprocity failure. It requires little adjustment. This control adds or subtracts color as exposure time is increased; it prevents color or density shift when prints of various sizes are made from the same negative.

The color comparator supplied with the system helps you analyze the results of the full frame 4 x 5 test print. The processed and dried test print is inserted in a light box and viewed through an aperture. A filter wheel is pulled into position and rotated until the print appears to be in the proper color balance, at which time the filter color and its density are read from an adjacent window, then marked on the back of the test print. This information is fed into the correction circuit of the com-

(continued on page 51)

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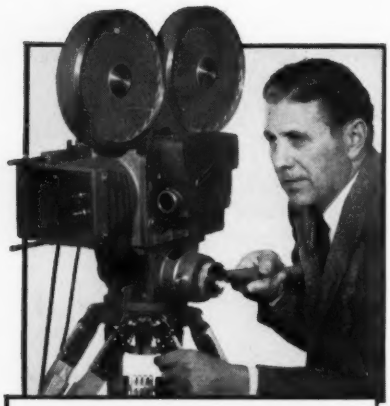

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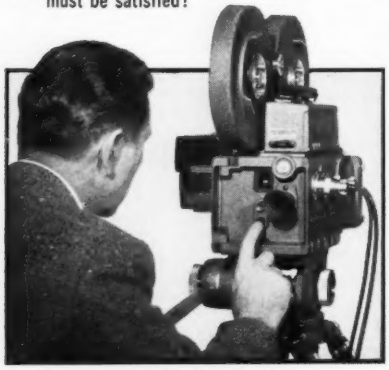

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Get more information. Circle 404, page 59

by Arnold Eagle

INDUSTRIAL MOTION PICTURES

Natural and effective technique for the zoom and the dolly shot

Last month in this column we discussed the pan and the tilt—two important camera movements. To continue our discussion of camera movements, this month we will look at two equally important ones: the dolly shot and its close relative, the zoom shot.

Both the dolly shot and the zoom shot involve an apparent motion toward or away from the subject during a film sequence. Simple on the surface, both these methods of camera movement may present unexpected difficulties. To appear natural and effective they demand a mastery of the special techniques and equipment involved.

The industrial photographer is most likely to make use of portable equipment for dolly shots. Probably the most popular for this application is a folding three-rubber-wheeled contraption supplied with a bicycle seat for the cameraman. It works, but it's hardly the most efficient dolly. There is no comfortable space on it for an assistant to ride and change the focus as the distance between the subject and the camera changes. Furthermore, it's not likely to ride in a perfectly straight line. Thus it is hard to repeat a route precisely.

More effective is a four-wheel dolly and light aluminum tracks. The tracks are supplied in short sections and can be laid quickly.

Imperative to smooth dollying is following focus accurately, so the image stays sharp even while the camera moves. There's no substitute for an experienced assistant cameraman in accomplishing this, but there are some tricks which help. One method is putting chalk marks on the floor at regular intervals and having someone call out the distance to the assistant cameraman as the camera passes the marks. Some assistant cameramen tape a string to the focusing ring of the lens, then change the focus by pulling the string down with a steady motion. A recent improvement is provided by a remote control focus-changing device offered with the Mitchell camera.

Dollying in on a close-up is especially difficult. If you miss your mark in framing by the slightest amount, it's apt to show. Focus is more critical at close quarters. In extreme close-ups, furthermore, it takes a movement of but a short distance toward the subject to increase the image size appreciably. Thus if you dolly toward the subject at a constant speed, the image on the screen may not only enlarge, it may appear to explode before the eyes of your audience.

A dolly shot which draws away from the subject is usually easier because the camera can be centered exactly when centering is most critical—closest to the subject. Some cameramen use a reversal trick for dollying in on extreme close-ups. They turn the camera upside-down and pull back from the subject. After the negative is developed, they turn the whole dolly sequence around and splice it into the remainder of the film. The effect is a dolly toward rather than away from the subject.

The time-saving zoom

A simpler and perhaps more economical way to effect a dolly shot is with a variable-focal length zoom lens. It changes automatically from a short to a long focal length lens with the adjustment of a lever. The zoom lens creates the effect of moving toward or away from the subject while, in fact, the camera and the subject remain the same distance apart. The zoom lens can save the cameraman the complications of the dolly shot.

But a zoom shot is not a *duplicate* of a dolly shot. Suppose the zoom is used to give the effect of moving the camera closer to the horses in

(continued on page 53)

KODAK REPORTS TO INDUSTRY

The *print* is your ambassador...

Your artistry and skill are displayed on the print. Without a good print, even the finest negative might just as well not have been made. Your employer (or client) sees the print, not the negative.

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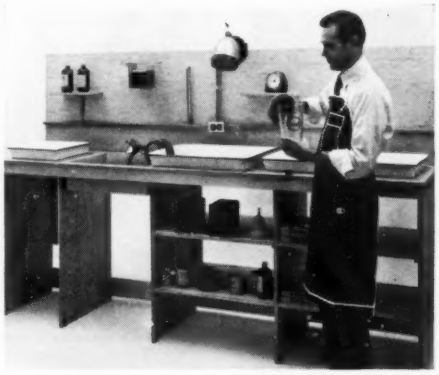
Thus, your choice of printing paper reflects both your technical ability and your creative judgment.

To satisfy diverse needs and preferences, Kodak makes an extremely wide range of papers. Your dealer carries a great many of these, can order others on short notice.

But for your general run of printing, three or four basic papers—suggested below—more than fill the bill.

See your Kodak dealer's print sample book for graphic comparisons.



"Made together to work together" is our way of saying that you get full value when you process Kodak Papers with the recommended Kodak Packaged Chemicals. For example, Polycontrast normally works best with Kodak Dektol Developer. Kodabromide Paper achieves maximum speed, brilliance, and contrast with Dektol, as does Kodak Azo Paper. Or, Kodak Selectol Developer can be substituted when you need a softer, warmer image tone.

For rich blacks and sparkling whites, Kodak Medalist Paper is a long-time favorite with professionals. Medalist has the tonal range that's so important in industrial photography. And, by varying exposure and development times, you can achieve subtle variations in tone from softer to harder than normal. Medalist is fast enough for quantity runs, but not too fast when careful dodging is required.

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This year's has been named the "Years-Ahead" Conference because of its emphasis on *The New*. It will prepare you to utilize, in your own work, some of the important developments of recent months.

Its practical, down-to-earth sessions will be conducted by leaders in our field. They include Edward J. Ellis of Ford, James E. Hampson of Arkansas Fuel Oil Corp., Robert R. Goodwin of General Electric, Earl Mercier of Olin Mathieson, Ervil C. Kennett, Jr., of Raytheon, Joseph C. Gonzalez of Procter & Gamble, etc.

The National Industrial Photographic Conference has become the most important event of the year to photographic specialists for industry. This year's should be the best one yet. The Conference dates are advancing on us rapidly. Act now to attend!

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Get more information. Circle 453, page 59

MORE PICTURE PER INCH

SMALL CAMERAS are coming into their own in industry. Although 20 square inches of film or better per exposure is still practically synonymous with professional photography, industrial and otherwise, improvements which make smaller formats more practical—such as high resolution, thin emulsions and rare earth element glass—are having a profound effect. The photographic process is capable of rendering more detail in a given area than ever before, and workers in industrial, scientific and reproduction photography are taking advantage of the fact to reduce their equipment load and make their operation more flexible.

In plants where any camera smaller than 8 x 10 was once ignored, contact printers have been metamorphosed into proofing machines for 1 x 1½-in. negatives, three dozen at a wink. In reproduction departments where the smallest image bearer was once half the size of a desk top, images half the size of a postage stamp now bear, in microscopic detail, the plans for giant gear. Hip pockets once reserved for slides and holders now bulge with roll film and cassettes enough for up to 90 times as many exposures.

PMI sees the change not as a revolution but as the normal development of a trend gaining momentum. Certain branches of the photographer's craft standardized upon it from the first: motion pictures, microphotography, magazine photojournalism and transparency color, for example. Men with vision know that the small camera has a place in industry too.

The pages that follow survey in words and pictures some of the highly appropriate uses and techniques of the small camera in functional photography. PMI hopes they may serve you well.

The Editors

35MM

HOW IS IT USED IN INDUSTRY?

Industry and science have recently made a perceptible switch to the 35mm camera and the handy film that goes along with it. To judge its extent, PMI sent a questionnaire to a random sampling of its readers. All the 83 that answered had 35mm cameras. The average estimate of the extent of the 35's use is 8 per cent of the work. One does not use it at all, except for experiments on his own. Eighty-five per cent of the respondents use 35mm materials for color transparencies, slides, strips and stereo slides. Half make use of black-and-white miniature materials. Sales promotion tops the list of applications, 60 per cent—with technical applications a close second, 53 per cent. The technical applications include photomicrography, 31 per cent, engineering records and reports 25 per cent, data recording, 19 per cent. Nine per cent employ the camera for identification photos.

SALES PROMOTION

It's not only the giant industrial firms who can make use of small camera photography. Peterson Builders, Inc., of Sturgeon Bay, Wis., is a small firm whose products are too large to go into a sample case. Frequently the firm's customers have no opportunity for a firsthand look at the equipment—including boats—that they are buying. Though naturally interested in the progress of their order, they have no opportunity to travel to Sturgeon Bay on an inspection tour. Arne Benzow, Peterson Builders' photographer, solves the problem with 35mm color slides recording the progress of the work. These and a simple hand viewer travel to the customers' desks in the pocket of a company official. No other sales promotion device is so portable says Benzow.

Boat in a pocket

PUBLIC RELATIONS PHOTOGRAPHY

Two busy men in Indianapolis, Ind., James R. Root and William C. Herman, produce the thousands of pictures used by Eli Lilly and Co., world's largest ethical pharmaceuticals manufacturer, for publicity and employee publications. Not the least of their tools is the 35mm camera loaded with fast film. Getting picture stories with a minimum of equipment and disturbance, and the ability to provide the public relations department with a wide choice of photographic variations on those stories with a minimum of expense are the chief advantages which their 35mm cameras and a variety of fast lenses and negative materials offer these prolific industrial photojournalists. Without miniature equipment, their assignment would be impossible.

Pictures in profusion

SOUND FILMSTRIPS

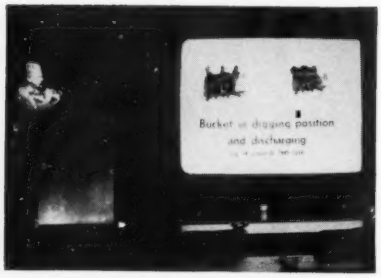
The rural landscape from Vermont meadows to the San Fernando valley is dotted with equipment manufactured by the New Holland Machine Company in New Holland, Pa. Keeping dealers apprised of product changes and interesting farmers in improved equipment is an annual project for this firm—with local variations dependent on the growing season. To tell its story convincingly, but with the flexibility necessary for proper timing in each locality, New Holland calls on their Supervisor of Photography, Robert I. McCollough, for sound filmstrips. He supplies the color transparencies of artist's drawings, equipment in the field and product shots. Accompanied by a record, multiple color prints of the 35mm strips are dispatched from New Holland.

Johnny-on-the-spot sales message

IDENTIFICATION PHOTOGRAPHY

The Personnel Department of the A. E. Staley Manufacturing Co. in Decatur, Ill., keeps its employee records complete with a photographic system that is ideal for economy and simplicity. Jack L. Allsup, Public Relations Department photographer, outfitted personnel workers with an inexpensive 35mm camera, two photofloods and a camera stand. When an employee is hired, personnel workers spell out his name on a title board, turn on the lights and press the button. Allsup does the rest, after the roll of film is completed. He develops the film and makes a single contact sheet. This is returned to the Personnel Department where the contacts are trimmed down and inserted into pre-cut slits in employee record cards.

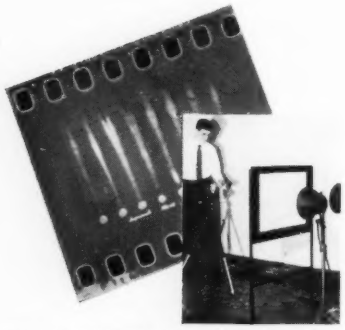
Simplified, positive identification



Rear projection, close contact

SLIDE TRAINING PROGRAM

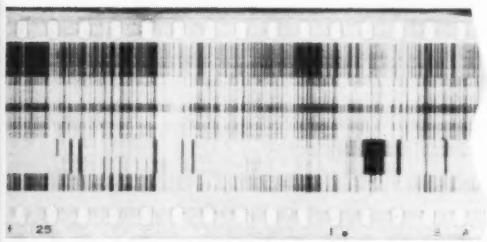
The Barber-Greene Company has headquarters in Aurora, Ill., but the road building machinery it builds operates around the world. To keep salesmen up to date with the firm's products, and to instruct assembly and maintenance men, Barber-Greene runs week-long training sessions on various phases of their products throughout the winter when road building is least active. 35mm slides in monochrome and color play a most important part in the training schools because they are quick to make, easy to present and because their order may be adapted for various phases of the training. Vernon Derry's photo lab staff makes the slides throughout the year and presents them during the training session. They make use of a rear projection system.



Chemical analysis by photography

FLUORESCENT CHROMATOGRAMS

At the Boyce Thompson Institute for Plant Research, in Yonkers, N. Y., where precise knowledge of chemical traces is an important adjunct to analysis and development work, a 35mm camera in the hands of Wm. B. Smith, Chief of the Institute's Illustration Division, is used to record paper chromatology tests. The technique is a system of qualitative and quantitative chemical analysis most often used by chemists dealing with organic and biological preparations. A sheet of paper is treated with chemical solutions which dry. Ultraviolet illumination from the rear reveals indicative colors of solutions being analyzed. Smith records them on color film. In the example illustrated he used two G. E. BH-4 100-watt lamps, daylight Kodachrome, a 2B filter, 1 min. exposure at f/3.5.



Element's signatures

SPECTROSCOPIC ANALYSIS

Over two-thirds of the technical applications of photography don't result in anything the lay public could readily identify as a picture. The lines on this fragment of 35mm film—part of a yard-long strip sent in by Gene Lyle, Engineering Photographer, Rohr Aircraft Corp., Chula Vista, Calif.—aren't significant to anyone who is unfamiliar with spectrographic analysis. But to men and women in the field this picture unquestionably tells more than a thousand words. Each element in the sample under analysis emits light at definite wavelengths. A good spectrograph man can identify the lines by memory, and by their density estimate the quantity in which the element is present. The "camera" in which the film is shot is the size and shape of a grand piano.

Metal analysis in quantity

METALLOGRAPHIC REPORTS

Haynes Stellite Co., a Kokomo, Ind., division of Union Carbide, is engaged in the production of specialized heat and corrosion resistant alloys. Even more specialized is their distribution system which involves metallurgical engineers as buyers and sellers. Information is as important to this firm and its sales efforts as are its products. The photographic department under Willis F. Bertram makes wide use of 35mm cameras and film for metallurgical photomicrography and micrography studies. He makes prints from his 35mm negatives, then reproduces prints with a process camera on offset negative material. Two hundred copies of the reports, each containing from 2 to 25 illustrated metallurgical studies, keep all concerned up on the latest developments.

OSCILLOSCOPE TRACING

By mounting a 35mm camera in a special housing, Chief Photographer Robert A. Wellman has enabled engineers to add precision, ease and an accurate permanent record to oscilloscope tests at the Kenosha, Wis., plant of the American Motors Corporation. In its housing, the 35 just covers the oscilloscope screen. Wellman has focus, aperture and shutter permanently adjusted—making it a simple matter for engineers to fit the housing on the oscilloscope when they have a pattern in which they're interested, and click the shutter. Wellman's department develops the fast film in D-19 for contrast, makes glossy prints for engineers. As in an engine mount dynamic forced vibration test (*right*), engineers then make overlay tracings for mathematical computations.

Engine mount vibration pattern

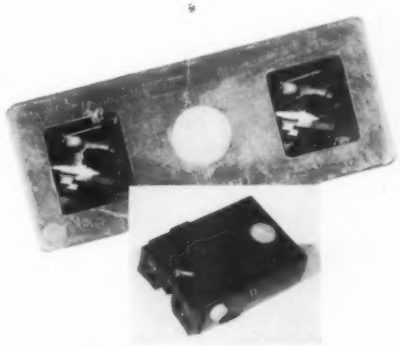
EXECUTIVE PORTRAITS

The trouble with old-fashioned industrial portraits was that the camera frequently came between the photographer and his subject. There was just too much apparatus; setting-up was a strange, fascinating and disruptive process, and by the time the picture was to be made, the sitter was either tense, bored, or annoyed. Morris Gordon, who makes the bulk of the executive portraits for the vast Western Electric Co., gets large camera quality with the 35, and in addition can work so fast and so unobtrusively that his sitters never get a chance to stiffen up, and can never complain that he takes up too much of their valuable time with unproductive preliminaries. The results of this happy combination are technically excellent, relaxed, character ladden portraits.

Unobtrusive camera, character laden faces

ENGINEERING COLOR STEREO

Photography's ability to observe action that evades the unaided eye has long been a boon to the engineer in studying the processes he aims to improve. To these ends, Joseph W. Lyons of the Colgate-Palmolive Company in Jersey City, N. J., has long been providing aid to his firm's engineers. Recently Photographer Lyons extended the dimensions of his service by providing stereo color slides to engineering groups in his firm. "A stereo shot offers much more information than we would obtain from a straight photograph," he says, and adds that "such work has stimulated interest in our Research Sections. We are developing new applications of stereo to scientific projects." Lyons has found that color film and a single flashbulb are an ideal combination for this work.



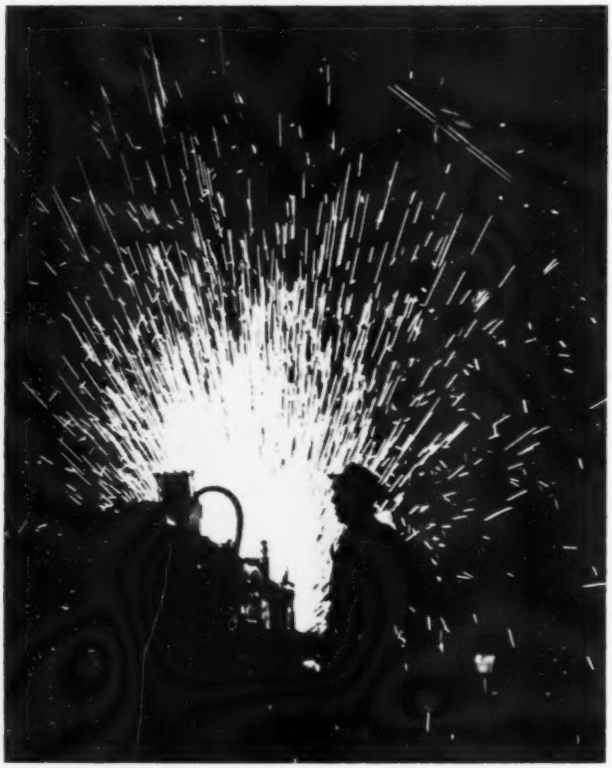
A third dimension for engineers

COLOR PHOTOMICROGRAPHY

The microscope is the instrument through which much of the research work of the Agricultural Experiment Station, Iowa State College, Ames, Iowa, is done. Photographer Louis A. Facto uses a 35mm camera for color photomicrography. The slides he makes are used for study projection, for illustrations at scientific meetings and in reports, and for classroom instruction. So many variables are involved in color photomicrography that exposure and color balance are seldom a certainty. Trial and error is the only reliable method for getting results. "But thanks to the economy of 35mm film," says Facto, "it is not extravagance to make many exposures of the same subject, so that the most accurate slide may be selected for the job in hand." Duplication and printing are cheap.

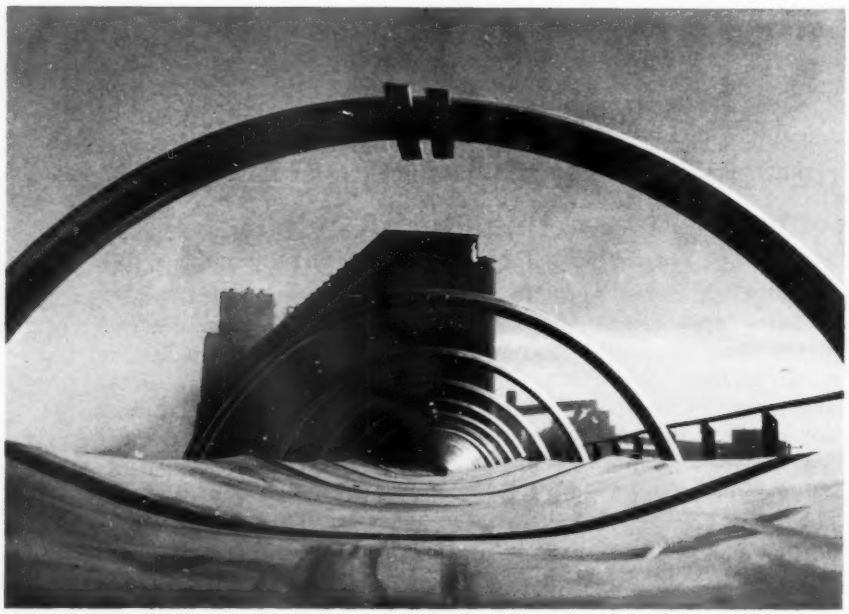
Beef, sliced very thin

ROSS A. CATANZA, Brady Stewart Studio, Pittsburgh, Pa., studied the workings of a welding machine at the Spang Chalfant Plant in Etna, Pa., then picked his angle, watched for a shower of sparks and shot. The picture made a cover for the company magazine. Rolleiflex, 1/25 sec., f/3.5, Tri-X film.



R. S. JOHNSON, Ford Motor Company, Dearborn, Mich., framed the operator with his machine in a picture made on an assignment to cover the molding of small plastic gears. He used a Speed Graphic with a 127mm Ektar lens at f/11, three No. 5 flashbulbs, two in front, one for backlight. 4 x 5 Royal Pan developed in D-76.

JACK ALLSUP, A. E. Staley Manufacturing Company, Decatur, Ill., covered the installation of a half-mile long conveyor belt for his company's publications. He took advantage of the startling perspective of the long stretch of belting to make this striking shot—which tells the story both in detail and with wide scope. To make the picture, Allsup climbed aboard the conveyor, placed his Rolleiflex directly on the then motionless belt. He shot at minimum aperture of f/22 for depth. Exposure was 1/125 sec. on Kodak Tri-X, developed in Panthermic 777.



PMI's Monthly

READERS' SHOWCASE

Five of PMI's readers supply pictorial solutions to industrial photo problems.

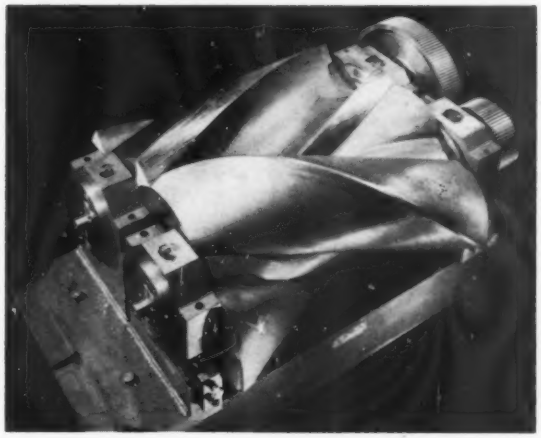
A couple of months back, PMI asked the question: What has been your most imaginative pictorial answer to a run-of-the-mill assignment? The response from readers is sampled in the five pictures on these pages. They portray industrial scenes often encountered: familiar subjects made vital because the photographer saw beyond the superficial and recorded his impression well.

Jack Allsup made his shot from a point of view a person at the scene would almost surely overlook; his effort was rewarded with an original and intriguing photograph. A worker's silhouette distinguishes Ross A. Catanza's photograph of welding fireworks. The man furnishes a striking contrast of tone and idea—the worker's casual mastery of the fiery drama around him. C. R. Anderson's flawless technique reveals the precision and smoothness of his subject vividly. B. J. Nixon took advantage of nighttime lighting to improve upon an ordinary assignment. R. S. Johnson added the human element to make his industrial shot more telling and interesting.

You are invited to send in your pictures for this feature. Here are the details:

There are two rewards for each of the pictures chosen. The first is knowing that your picture will be seen by appreciative fellow professionals. The second is $10.00. Please include your name and your company's name, a note about the picture and how it was used, and the technical data. Send them to SHOWCASE, PMI, 33 W. 60, New York 23, N. Y.

C. R. ANDERSON, Rockford Machine Tool Co., Rockford, Ill., was assigned a "straight" shot of highly finished rotors in a test stand. He emphasized the quality of the machining with his own superb technique. Calumet View camera, 12-in. Bausch & Lomb Tessar at f/32. 8 x 10 Royal Pan exposed 2 sec., one spot, four floods.



B. J. NIXON, Newport News Shipbuilding & Dry Dock Co., Newport News, Va., stayed at the job till dusk to make this shot. He used a Speed Graphic on a tripod, closed lens to f/32 and opened shutter while he directed light of seven No. 5 flashbulbs against hull. Royal Pan.

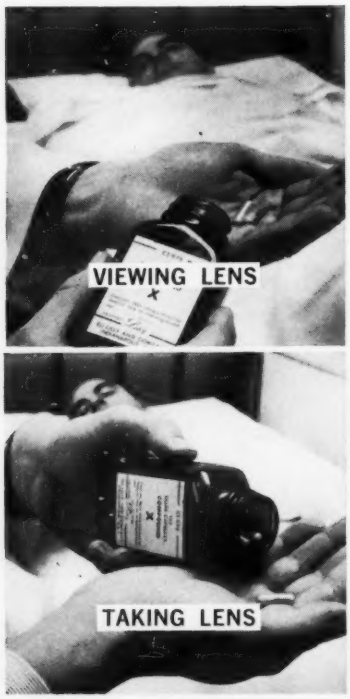
SOLVING TWIN-LENS REFLEX PROBLEMS

by William C. Herman & James R. Root

Few photographers limit themselves to one camera; every one of them has some feature which enables it to do a special job better than another. We use everything from 11 x 14 to subminiature 16mm, but our workhorse is the 2¼ x 2¼ reflex.

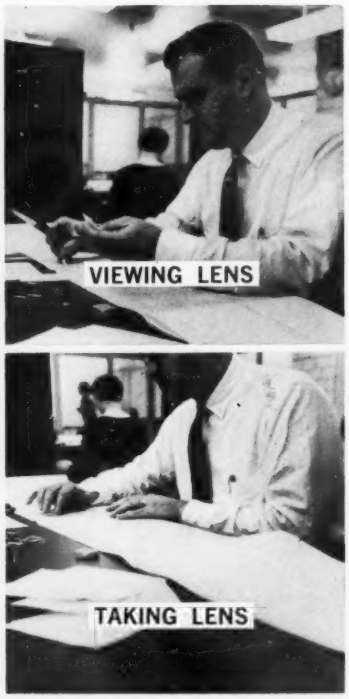
It is rugged, compact and tremendously maneuverable. Our pockets can carry as many exposures as 60 holders in a heavy gadget bag. Even with a minimum of developing equipment it is possible to process many rolls of film at one time. When we're traveling, it is a simple matter to keep the film flowing back to the lab for processing. Contact print sheets, one for each roll exposed, can be printed quickly for easy picture selection. The fast, short focal length lenses available with the 120 reflex make it a natural for available light pictures, but it adapts to the flashbulb and electronic flash as easily as any other camera. Here's how we put the twin-lens reflex to work for our employer, Eli Lilly and Company:

SOLVING PARALLAX PROBLEMS •



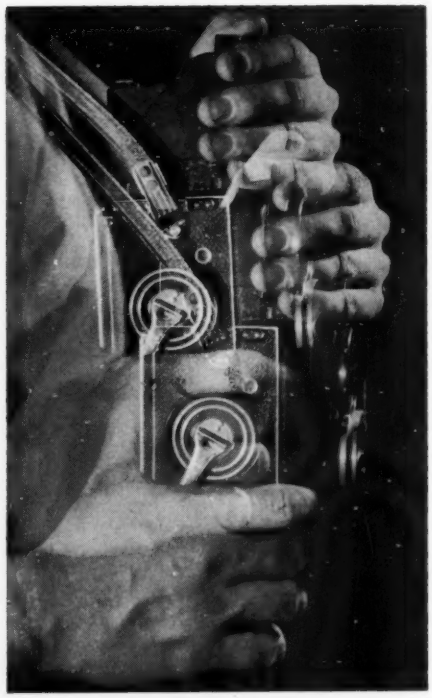
Corrected Viewfinder

Even with automatic parallax correction, objects near camera can obstruct background, as in *lens* shot. The foreground was rearranged to reveal patient's face.



Uncorrected Finder

Without parallax correction, viewer coincides with taking field only when subject is at infinity. The difference between the two, however, is disastrous only in close-ups.



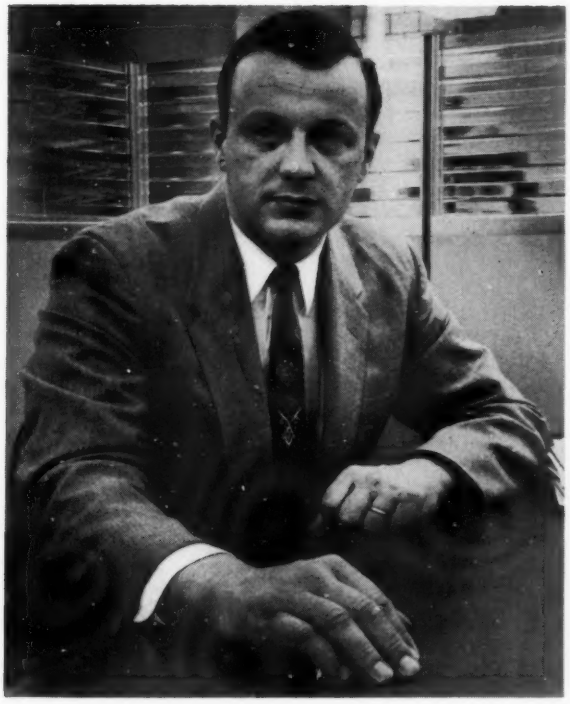
Practical Remedy

To avoid either type of parallax problem, after composing picture, lower camera a couple of inches, so viewing lens occupies same position as taking lens did. Check for parallax; if not O.K., recompose.

CONVERGING VERTICAL LINES •

Our eyes play tricks on us: the picture on the left gives the illusion that the top of the building was squeezed together. It's contrary to common sense, but exactly the way you'd see the building if you viewed it from camera angle. (Try looking at the picture close up from below, and watch it pop back into reality!) Without rising front on twin-lens reflex, we "correct" for convergence *(right)* by tilting enlarger easel *(center)*, using small aperture for depth.

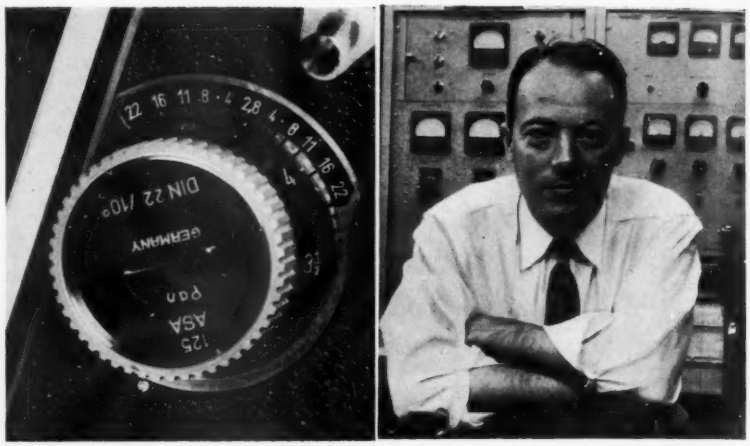
"DISTORTION" IN CLOSE-UPS •



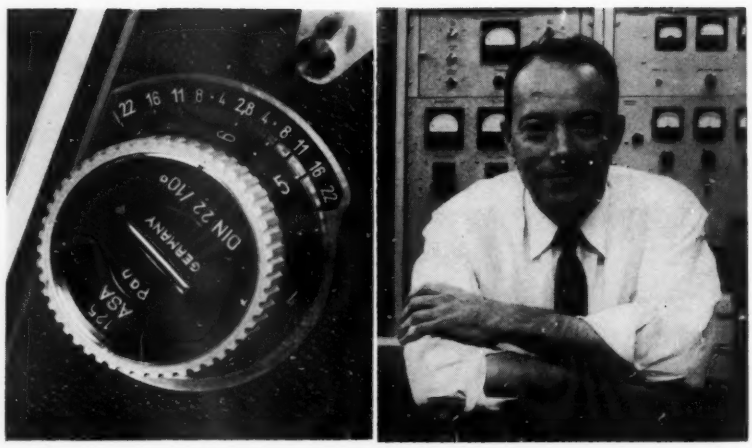
Lenses supplied with most twin-lens reflexes are relatively short, and when used close up they are apt to produce a seeming distortion, exaggerated to grotesque proportions in the hand of the man *above*. Actually it's a duplicate of the perspective you'd see at the camera's distance from the subject. We overcome the problem in portraits by making sure arms, hands and shoulders are approximately the same distance from the camera as the face, *above*, but don't hesitate to exploit foreshortening to give added emphasis to foreground objects.

CONTROLLING DEPTH OF FIELD•

The 75 or 80mm lenses supplied with most 2¼ x 2¼ twin-lens reflexes give great depth of field—and the cameras are for the most part designed so the photographer can take advantage of the built-in depth to the utmost. Still, in many cases it's squandered by photographers who should know better. The picture, *right*, is a bad example. The man is 5 ft. from the camera, the aperture at f/16. Foreground is included in the zone of sharp focus, and the background (at 7½ feet) is out of it. All right if the photographer wants selective focus, but he'd be better off opening the lens, focusing on the subject and shooting faster.



This shot—same subject, same aperture, same shutter speed—was made taking full advantage of the depth of field offered by the camera. Again the foreground is 5 ft. from the camera and the background at 7½. The focus knob was adjusted so the two distances are just included between the two marks for f/16. This is a much more precise method of using depth than following the rule of thumb "focus at ⅓ the distance between the near and far limits of important subject matter" which can be entirely *wrong*. If you're in doubt about your camera's depth of field scale, check it with the appropriate depth of field table *below*.



Depth of field is a relative matter. The columns below the top row of f-stops are a practical guide (based on a circle of confusion of 1/1400 of focal length). They should check with the scale on your camera. Read the bottom row of f-stops for more rigorous figures based on a circle of confusion of f/2000. Courtesy Franke & Heidecke.

Depth of field (in feet) 75mm lens

Diaphragm		4	5.6	8	11	16	22
Taking distance (in feet)	∞	141' – ∞	86' – ∞	61' – ∞	43' – ∞	31'4" – ∞	21'6" – ∞	15'7" – ∞
	60'	43' – 105'	35' – 198'	30'3" – ∞	25' – ∞	20'7" – ∞	13'10" – ∞	12'4" – ∞
	30'	24'9" – 38'	22'3" – 46'	20'2" – 59'	17'8" – 99'	15'4" – ∞	12'6" – ∞	10'3" – ∞
	20'	17'6" – 23'4"	16'3" – 26'	15'1" – 29'8"	13'8" – 37'	12'2" – 55'	10'4" – 290'	8'9" – ∞
	15'	13'7" – 16'10"	12'9" – 18'2"	12'1" – 19'10"	11'2" – 23'	10' – 29'8"	8'10" – 50'	7'8" – 350'
	12'	11'1" – 13'2"	10'6" – 13'11"	10' – 14'8"	9'5" – 16'8"	8'8" – 19'6"	7'8" – 27'1"	6'10" – 52'
	10'	9'4" – 10'10"	9' – 11'3"	8'7" – 12'1"	8'2" – 13'2"	7'7" – 14'10"	6'10" – 19'	6'1" – 27'3"
	8'	7'7" – 8'6"	7'3" – 8'10"	7'2" – 9'2"	6'10" – 9'9"	6'6" – 10'7"	6' – 12'3"	5'3" – 15'8"
	7'	6'8" – 7'4"	6'6" – 7'7"	6'5" – 7'10"	6'1" – 8'3"	5'8" – 8'10"	5'3" – 10'1"	4'12" – 12'1"
	6'	5'9" – 6'3"	5'8" – 6'5"	5'6" – 6'7"	5'4" – 6'11"	5'2" – 7'4"	4'9½" – 8'1"	4'5½" – 9'4"
	5'	4'10½" – 5'2"	4'9" – 5'3"	4'7½" – 5'3"	4'6½" – 5'7"	4'4½" – 5'10"	4'1½" – 6'4"	3'10½" – 7'1"
	4'	3'10½" – 4'1½"	3'10½" – 4'2"	3'9½" – 4'2½"	3'8½" – 4'4½"	3'7½" – 4'6"	3'5½" – 4'9½"	3'3½" – 5'2"
	3,5'	3'5½" – 3'6½"	3'4½" – 3'7½"	3'4" – 3'8½"	3'3½" – 3'9½"	3'2½" – 3'10½"	3'1" – 4'1½"	2'11½" – 4'4½"
	3'	2'11½" – 3'½"	2'11" – 3'1"	2'10½" – 3'1½"	2'10" – 3'2½"	2'9½" – 3'3½"	2'8½" – 3'4½"	2'7½" – 3'6½"
Diaphragm		3,5	5,6	8	11	16	22	

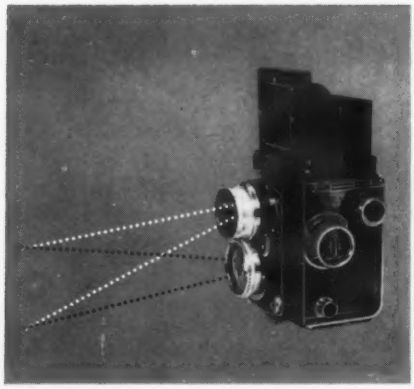
Depth of field (in feet) 80mm lens

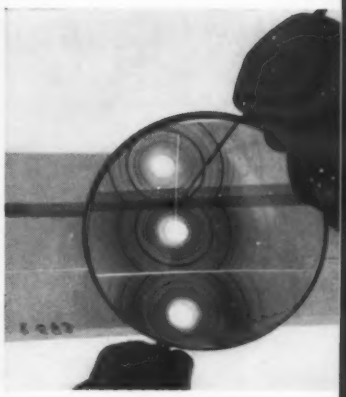
Diaphragm		2.8	4	5.6	8	11	16	22
Taking distance (in feet)	∞	187' 4" – ∞	131' 3" – ∞	93'10" – ∞	65' 7" – ∞	47' 9" – ∞	32'10" – ∞	23'10" – ∞	16' 5" – ∞
	60'	43'11" – 85' 4"	41' 6" – 109' 9"	36'10" – 164' 4"	31' 8" – 690' 7"	26'10" – ∞	21' 6" – ∞	17' 4½" – ∞	13' 2" – ∞
	30'	25'11" – 35' 7"	24' 6" – 38' 8"	22'11" – 43' 9"	20'11" – 55' 6"	18' 7½" – 79' 7"	15'11" – 312' 8"	13' 6½" – ∞	10'11" – ∞
	20'	18' 1½" – 22' 4"	17' 5" – 23' 6"	16' 7" – 25' 3"	15' 5½" – 28' 5½"	14' 3" – 33'10½"	12' 7" – 49' 9½"	11' 1" – 114'11"	9' 3½" – 197' 5"
	15'	13'11" – 16' 3"	13' 6" – 16'10½"	12'12" – 17' 9"	12' 3½" – 19' 3½"	11' 6½" – 21' 7"	10' 5" – 27'	9' 4½" – 38'10"	8' 1½" – 145' 7"
	12'	11' 4" – 12' 9½"	11' 1½" – 13' 2"	10' 8½" – 13' 8"	10' 3" – 14' 6½"	9' 8½" – 15' 10"	8'11" – 18' 7"	7'10½" – 23' 5"	7' 1½" – 41' 5"
	10'	9' 6½" – 10' 6½"	9' 4" – 10' 9½"	9' 1" – 11' 1"	8' 9" – 11' 8½"	8' 4½" – 12' 6"	7' 9½" – 14' 1½"	7' 3½" – 16' 8½"	6' 4½" – 24' 3"
	8'	7' 8½" – 8' 4"	7' 6½" – 8' 5½"	7' 5" – 8' 8½"	7' 2½" – 9' 1¼"	6'11" – 9' 5½"	6' 6½" – 10' 4½"	6' 1½" – 11' 8½"	5' 6½" – 14'11"
	7'	6' 9½" – 7' 3"	6' 7½" – 7' 4½"	6' 6½" – 7' 6½"	6' 4½" – 7' 9½"	6' 2" – 8' 1½"	5'10½" – 8' 8½"	5' 6½" – 9' 7½"	5' ³⁄₁₆" – 11' 8½"
	6'	5'10" – 6' 3½"	5' 9½" – 6' 3½"	5' 8" – 6' 4½"	5' 6½" – 6' 6½"	5' 4½" – 6' 9½"	5' 1½" – 7' 2½"	4'10½" – 7' 9½"	4' 6½" – 9' 1"
	5'	4'10½" – 5' 1½"	4'10" – 5' 2½"	4' 9½" – 5' 3"	4' 8½" – 5' 4½"	4' 6½" – 5' 6½"	4' 4½" – 5' 9½"	4' 2½" – 6' 2½"	3'11½" – 6'11½"
	4'	3'11½" – 4' 1½"	3'10½" – 4' 1½"	3'10½" – 4' 1½"	3' 9½" – 4' 2½"	3' 8½" – 4' 3½"	3' 7½" – 4' 5½"	3' 6" – 4' 8½"	3' 3½" – 5' 1"
	3.5'	3' 5¾" – 3' 6¼"	3' 5" – 3' 7"	3' 4½" – 3' 7¾"	3' 4½" – 3' 8½"	3' 3½" – 3' 9½"	3' 2½" – 3'10½"	3' 1½" – 4'	2'11½" – 4' 3½"
Diaphragm		2.8	4	5.6	8	11	16	22	

CROPPING•

The square format of the 2¼ picture removes all temptation to turn the camera, but this doesn't mean the twin-lens reflex can't provide an art director with whatever shape of picture he needs for his layout. In the three examples above the square picture has been cropped to layout needs; in the first case a slim-Jim vertical, the third a shallow horizontal, while the center picture retains the original square format but "moves in" on the subject, eliminating extraneous surroundings and dramatizing the important part of the picture.

CLOSE-UP LENS•





Focusing closer than 40 in. is rarely possible with twin-lens reflexes without supplementary lenses, the best of which come in pairs matched for focal length. Furthermore, the viewing lens should be a wedge so that the two fields coincide, *above left*, to overcome parallax. Simultaneous viewing and shooting with the reflex camera permits solving complicated focus problems, *right*.

STEADY AS SHE GOES•

Long exposures

Normal use

Eye-level viewing

Sharp pictures result from careful focusing and a steady camera. We combine the two in the grip above which is our standard. One hand grips front and back of camera and trips shutter. The other steadies the top of the camera while we follow focus through the magnifier up to the moment the shutter snaps. For long exposures when no tripod or camera rest is handy, we add the support of a taut neck strap, *above left*. For eye-level shooting, interlock hands and grip front of camera around lens hood; press camera against cheek.

PHOTO DEPARTMENT ANALYSIS NO. 4

B.F.GOODRICH COMPANY

In a low budget darkroom in Akron, Ohio, "three photographers and a referee" turn out the bulk of the photographic work for a giant corporation whose yearly gross tops $700,000,000.

It's never been the subject of a United States patent, but one of the most spectacular inventions ever to come out of Akron, O., the rubber city, is the stretchable photographic buck.

While smaller outfits invest in high-powered spic-and-stainless darkrooms and toss last year's lenses to the office cleaners, the B. F. Goodrich Company, named by the American Institute of Management among the twelve best-run corporations in the country, manages to get a three-man department to turn out over 32,000 prints a year from 5,800 negatives shot on 2,400 assignments. This is accomplished with the simplest of equipment, chosen with an eye to price in the first place.

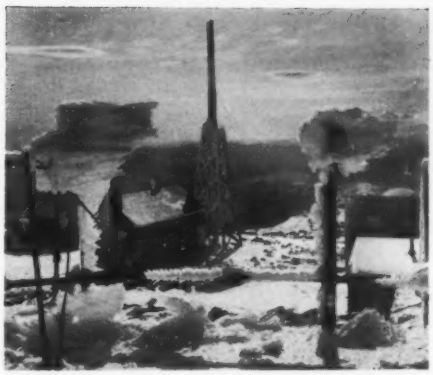
Public relations and employee magazine pictures account for 35 per cent of the department's work. Another 20 per cent is made up of pictures for the window display section. Each knocked down point-of-sale display is accompanied by photographs showing how it is to look when set up. In an interesting adaption of this idea, the staff has been working in relays making a detailed record of the disassembly of a complex rubber processing machine which is to be shipped overseas. The pictures are to aid in its reassembly.

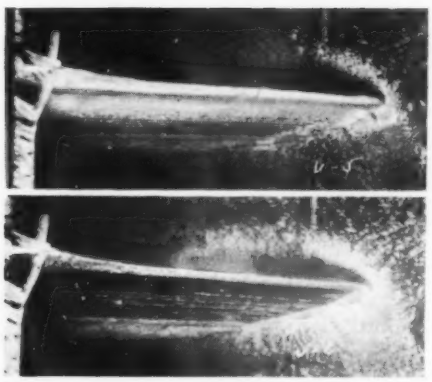
The remaining 45 per cent is a miscellaneous classification made up of odd jobs for use in engineering, tests, records, visual aids and any other operation where photography might help.

Three men and a girl

Getting large scale results with a minimum of staff and equipment is a tricky business, and it is an open question whether it would be worthwhile for other firms to attempt to cut their photo budgets anywhere near as close to the bone as Goodrich has. The primary consideration is, of course, personnel. The department was established in 1944. "Hube" Briers and Bob Coon have both been with it since its inception, while Andy Koloniar, transferred from another department, has almost 20 years of service.

AGAINST A BACKGROUND OF B. F. GOODRICH plants all over the world, the Akron photographic staff poses with small cameras. Left to right: Andy Koloniar, Hube Briers, Bob Coon and peacemaker Jane Skafec. Among the cameras can be seen two Rolleicords, two Stereo Realists, a Kodak Retina, an Exakta, a Polaroid Land Camera and a Speed Graphic, with Polaroid and 35mm backs. On assignment Bob Coon is just as likely to use his own Minolta reflex or Leica M3 as one of the office cameras. For studio work view cameras and a wide assortment of lighting is available, but on assignment small cameras are prefered for portability and low negative cost. With care compact equipment requires minimum of maintenance. ▼





▲

ATOP MT. WASHINGTON, N.H. Andy Koliniar (*right, center picture*) covers tests of BFG rubber swept-wing de-icer. Tests *(bottom picture)* were completely documented with 16mm Bolex, but Koloniar had complete assortment of still equipment along. Picture of weather station and TV tower was made with Rolleicord. In early days de-icer was mounted on wing outdoors and subzero temperatures and high winds did the rest. Now Air Force Development Center has built test hangar and dorms.

BFG LAB HAS ALL ESSENTIAL PARTS

With not an inch of space wasted and not an unnecessary dime spent, the B. F. Goodrich Photo Department still manages to have all the necessary equipment, and even such essential luxuries as thermostatically controlled water jackets for maintenance of even temperatures in film development; a filtered water supply and compressed air lines for keeping the chemical dust of the rubber industry out of cameras. Much of the plumbing equipment was made by plant carpenters and sheet metal workers, including the ingenious L-shaped stainless steel sink which makes most efficient use of the space available in a small, square darkroom. For purposes of administration, photo department forms part of art department, on same floor.

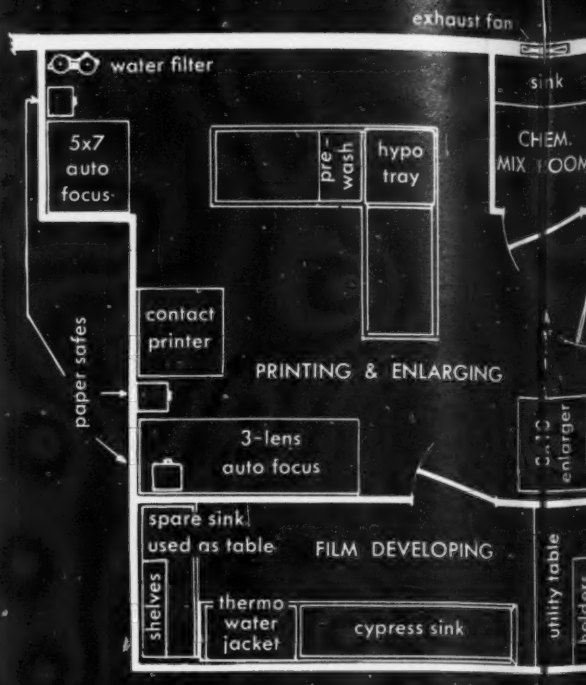


PHOTO DEPARTMENT ANALYSIS (*continued*)

These three share all the photographic jobs. Assignments and scheduling are in the hands of Jane Skafec, the department's secretary, impartial arbitrator and referee, who works directly under Ralph H. Hillbon, Art Director and manager of the Photographic Department. The darkroom is operated on a rota basis, each man spending one day in three processing. "Every few days we become the highest paid darkroom hands in Akron," they say. There is generally only one man in the darkroom at a time, but if necessary two can work there conveniently. Though the space is constricted, an unusual L-shaped sink makes efficient use of it. Most of the assignments go out in one or two prints. On large orders not intended for reproduction, a fine-screen plate is made and printed by letterpress for distribution.

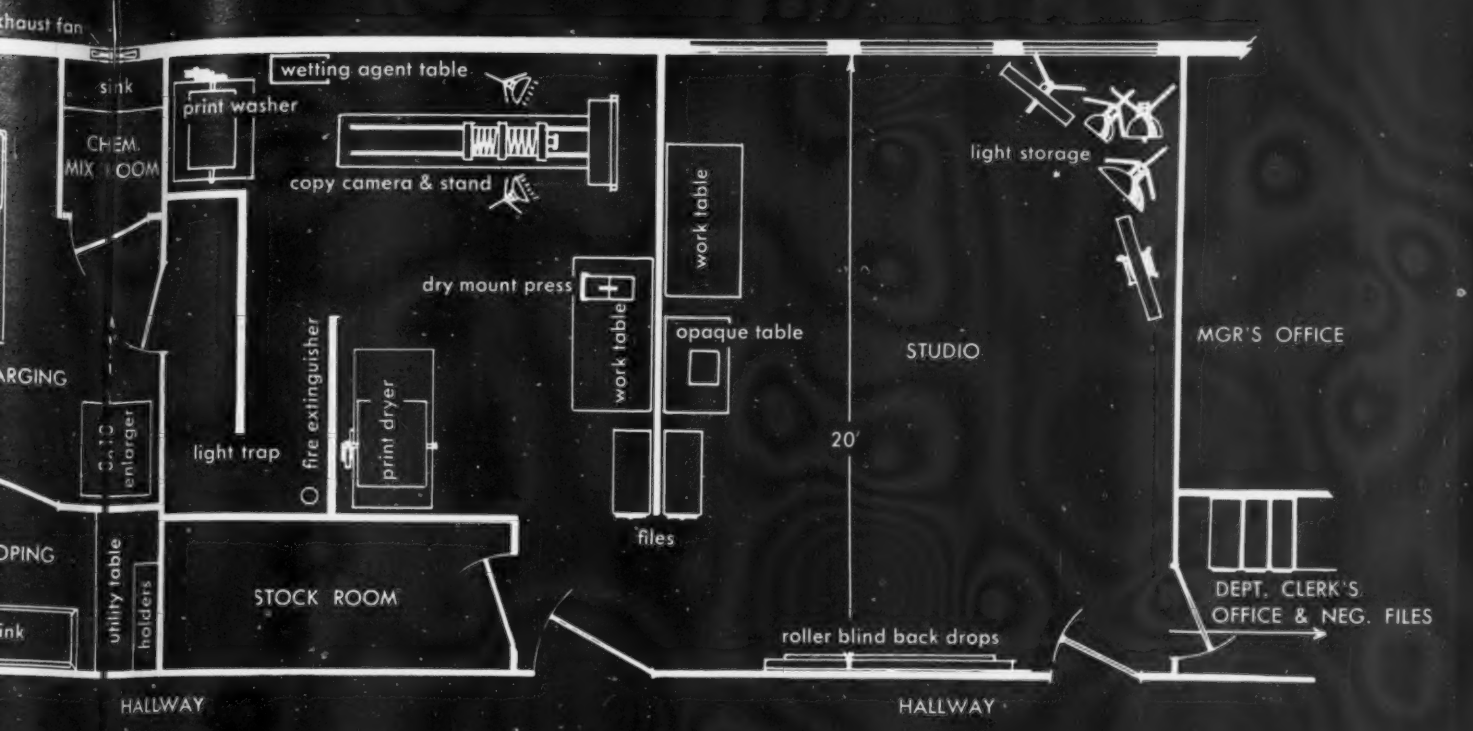
Streamlined equipment

As much as possible of the work is done with small cameras, for freedom of movement, saving in film expense and because it makes it possible to provide the client with masses of contact prints to choose from at little cost.

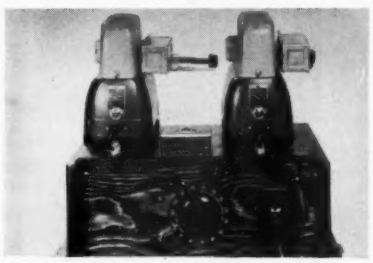
The small cameras used are two Rolleicords, an Exakta, a Retina II, two Stereo Realists and a Polaroid Land Camera 95A. As a matter of convenience Bob Coon sometimes does company work with his own Leica M3, for which he has 35mm, 90mm and 250mm lenses, or his Minolta reflex.

Aside from this, the stockroom boasts three Pacemaker Speed Graphics (with 35mm and Polaroid backs for them) and a Bolex H-16. Andy Koloniar, who shoots most of the BFG motion pictures, also has a Bolex of his own, which he uses.

Rubber manufacturing is a business that involves the use of some highly risky materials as far as camera life is concerned: carbon black, powdered soapstone and various other chemical dusts are abundant in the atmosphere. Cameras are always blown out with the compressed air line before loading, and sent to Bob Carson, Akron camera mechanic, for overhaul during the two-week vacation period every year. One of the inflexible rules of the organization is: "Never let trouble build up." At the first sign of trouble the cameras are brought to Carson, who also keeps a running check on their shutter speeds. "We're one of the few photographic outfits who operate on *actual* shutter speeds, not the ones marked on the indicator," says Coon. This results in more accurate exposure and, in the long run, a saving of film and photographer's time. The three BFG photographers are easy on cameras, but to stay on the safe side equipment is sold off after five or six years and replaced. *(continued on page 67)*



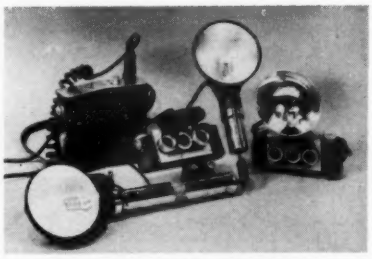
INGENUITY, EFFICIENCY AND ECONOMY HIGHLIGHT THESE BFG GADGETS.



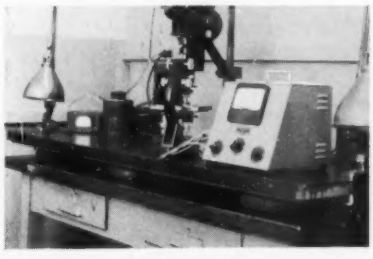
DISSOLVES AND FADES on slides are possible with this Variac-controlled pair of Kodak Master Projectors, rewired to permit lamps to dim and go out, while fans work continuously.

L-SHAPED SINK makes efficient use of restricted printing room space. Corner spot is occupied by roomy hypo tray which can be fed from either end. Hypo light is old display fixture.

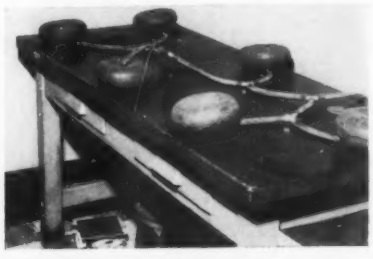
GREY SCALE TAPED to sink rim next to developing tray is always handy. Art department includes it on retouch and airbrush work for convenient and accurate comparison of tones.



MORE FLEXIBLE LIGHTING with the Stereo Realist, used for visual aids, is purpose of this double strobe system made by Akron camera mechanic Bob Carson. Ordinary Stereo Realist, *(right)*



PNEUMATICALLY CUSHIONED table minimizes vibration from processing machinery on floor below. Under upper wood surface, 200-lb. sheet of iron steadies top, kills momentum.



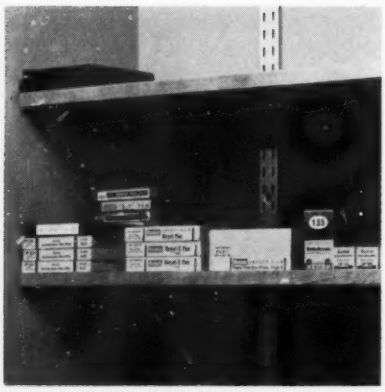
AIRCRAFT TAIL-WHEEL inner tubes form shock absorbers for vibration-free table. They are kept at constant pressure by air line which operates throughout laboratory areas.

FOUR STEPS TO FINE QUALITY

Small negatives can be great. These hints from Mike Anguti's Socony Mobil darkroom will help your processing make best use of today's fine film.

1 BEFORE THE EXPOSURE IS MADE

COOL STORAGE is essential for long film life. Buy in small lots and often, so stock is always fresh. Object is to keep film cool—not to freeze it. Kitchenette size refrigerator is big enough for job.

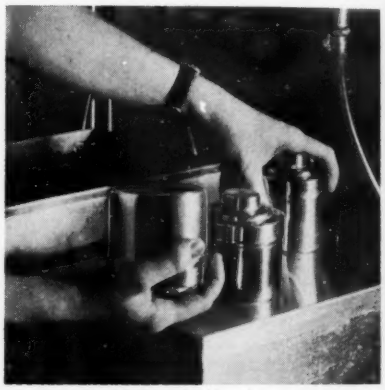


LET FILM WARM UP to room temperature before unwrapping, otherwise moisture in air might condense on surface and lead to serious emulsion defects. Droplets might make film stick.

MAKE WAR ON DUST: Even with air conditioned surroundings cameras get dusty. Compressed air lines is best way to blast grit out of equipment—but make certain air line itself is clean!

2 AFTER THE EX

SQUEEZE CASSETTE with thumbs and ease cap off. Pressure should be applied at top, near sprocket holes, not picture area, where friction might scar emulsion. Even tiny scrape shows up big.



SMALL TANKS are handiest for giving films individual treatment. Anguti and staff develop by inspection, but this is a knack with small films, requiring practice, best left to the old timers.

WASHING IN DEEP tank *(foreground)* is not dangerous provided films are not crowded. Wetting agent *(back tank)* is a must for even drying and elimination of streaks and water spots.

THE EXPOSURE

KEEP FINGERS OFF film when loading reels. Don't only baby emulsion side. An oily or damp fingerprint anywhere makes a sticky spot—perfect for trapping dust and grit particles.

NOT MUCH CAN GO WRONG in fixation as long as hypo is fresh and clean. Draining and refilling small tanks is slowish process so Anguti advocates fixing small films in large tank.

ANGUTI PREFERS living squeegee, formed of two fingers, to sponge, but points out that clean sponge is better than hands not 100% clean. Drying is done in professional dryer.

3 SOLUTION CARE

ANGUTI DUMPS developers used with Royal-X film after single use. Agrees with directions issued with film that fresh solutions are key to predictable results and maximum quality.

DEEP TANK developers are always kept topped up to lid level. Hand in jar mouth looks odd but is sure way to keep glass containers from slipping. Technique is harmless if hand is clean.

4 EXPOSURE CONTROL

MIKE ANGUTI'S SMALL CAMERA FILM SPEED RATINGS AND PROCESSING TIMES IN SELECTED DEVELOPERS
Minutes at 68°F, constant agitation

	120		35MM	
	Verichrome-Pan	Royal-X Pan	Panatomic-X	Royal-X Pan
Edwal Professional Paper Developer		(800) 2		
Dektol		(800) 2		
DK50				(400) 5-8
PRA	(400) 4-8			
Microdol	(80) 8-12		(80) 12	
Promicrol	(400) 4-8		(100) 12	

(Figures in parentheses are exposure indices)

PORTFOLIO NO. 4

Freshness of vision joins technical mastery in young Pittsburgh freelance Clyde "Red" Hare, whose unusual abilities discover strange, new poetic patterns in the often grim-looking world of heavy industry.

Even more exciting than watching a latent image come up in the developer is watching a photographer develop from promise to performance. At the age of thirty, "Red" Hare already numbers among his clients some of America's greatest corporations. To an industrial photographer, this spells success. But Hare has tasted a more personal brand of success, measured in satisfaction. He has managed to fix instants of his private vision on film and paper. Never without a camera over his shoulder, he sees more in the world around him than he photographs, although he makes pictures constantly, on assignment and on his own. Yet there is nothing of the lucky shot about his work. His pictures look as they do because he planned them that way—and because he has the sure technical skill necessary to carry his ideas through to the concrete reality of a print.

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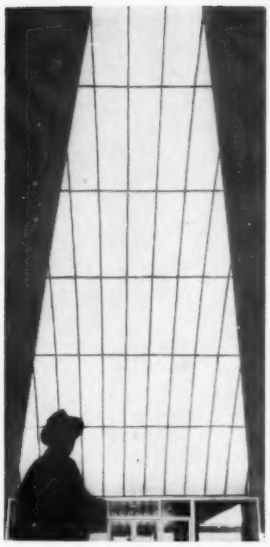
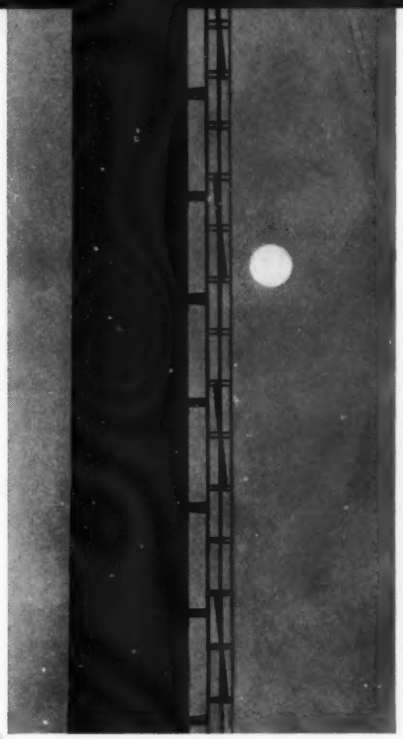


Skylight, St. Louis (1)



◄ *Blast furnace smokestack (2)*

Unloading ore, Lake Erie (3) ▼

◄ *School children, Pittsburgh (4)*

THE FORM OF INDUSTRY

Native talent is not enough. The photographs of Clyde Hare today are very different from the snapshots he took when his interest in photography was first awakened during a hitch in the Navy. Experience made the difference.

Two men are largely responsible for his development. The first was Henry Holmes Smith, whose course in creative photography at the University of Indiana taught Hare the rudiments of seeing like a photographer, and provided him with the basic technique that later experience was to broaden and refine.

The second major influence was Roy Stryker, for whom Hare worked at the Pittsburgh Photographic Library. "It's hard to say what Roy does for you," says Hare. "All I know is that when Roy's around, a photographer is inspired. Roy seems to instill such a powerful curiosity into people that it would take more than a 24-hour day to get it completely satisfied."

Curiosity plus trained vision plus technique—the ingredients that go to make up a photographer. Where does industry come in? It was there all the time. Hare took his degree in Management and Marketing at Indiana University's School of Business. It is precisely because Hare has a thorough understanding of both manufacture and distribution that his pictures go so deeply into the social aspects of industrial photography.

Tapping blast furnace, Pittsburgh (5)

◄ *Steel company president (6)*

Directors touring plant (7) ▼

Cleaning Bessemer furnace tweers (8)

Steelworkers union meeting (9)

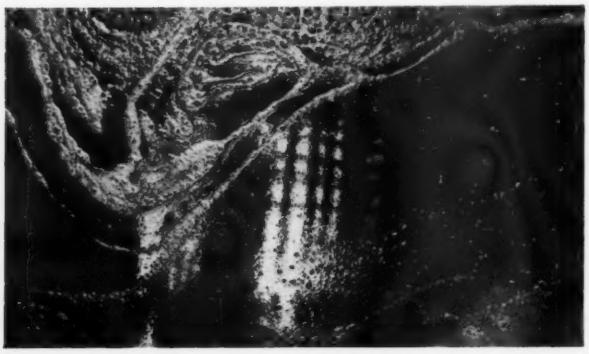
PHOTOGRAPHER'S ARSENAL

The tendency is to think of Hare as primarily a small camera user, but the fact is he uses the camera for the job—when he doesn't just use the camera he happens to have with him at the moment he sees a picture—and he probably will have a camera with him.

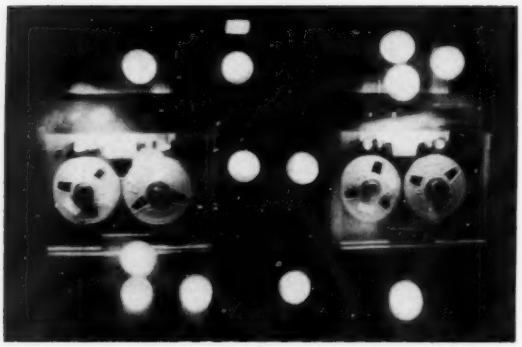
For example, the pictures used in this selection were made with a wide variety of cameras and lenses. The man beneath the skylight at St. Louis Airport was caught with a Leica wide-angle lens, while the same camera with a 200mm telephoto was used for the sun and the steelworks smokestack. He used a 4x5 Linhof with a 360mm telephoto for the silhouette of the ore shovels—called "hulots"—and the appealing study of school children coming back to Pittsburgh's Churchill Valley homes.

A Rolleiflex comes into the picture with the two steelworkers in protective clothing tapping a blast furnace, on the facing page. Mr. Joel Hunter, President of the Crucible Steel Company of America, and the Board of Directors touring the company's Midland Works were both photographed with the Leica, the portrait made with the wide-angle, the misty, atmospheric group-shot with the telephoto. At the meeting of the United Steelworkers Hare used the telephoto; for the men cleaning the tweers a 50mm.

Reflection, W. Va. industrial tower (10) ►



Petroleum blending in Pittsburgh (11)



Electronic computer (12)

PURE ART AND INDUSTRIALS

There is no answer to the question: "What is an industrial photograph?" An industrial photograph is any one used in industry. Generally the subject matter concerns the plant, its functions, its staff, or its product, but this isn't necessarily so. The late Robert Flaherty's *Louisiana Story* looked at first glance like a completely art-for-art's-sake documentary film; in reality it was a skillfully executed soft-sell oil company industrial movie.

A certain depressing grimness used to be the mark of the industrial photograph. There is no reason why "working" pictures should be made with a minimum of taste and imagination, but more often than not they are, but not by Clyde Hare.

When Hare turned his Leica on the process of petroleum blending, its 85mm lens caught a significance beyond engineering. The surface of the galvanized sheet metal (Linhof 4x5) is as technical as the detail of the cooling-tower piping (Rollei) but both are striking photographs. A study of the sun and a tower reflected in a quiet pool, (Rollei) and a rather abstract pattern of IBM machines and dots of light (Leica 125mm Hektor, Visoflex housing) look like pure art. It is interesting to note that these were both assigned pictures, made for a definite industrial purpose.

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◄ *Galvanized metal, close up (13)*

Pipes and spray in cooling tower (14)

PMI'S 70MM DIRECTORY

Highly specialized yet amazingly versatile, the 70mm becomes more and more important to technical photography daily. Here are principal ones.

There are cameras and there are cameras, but none are so thoroughly useful—or so little known outside their home grounds—as the 70mm jobs. Many photographers in industry and science have never seen one of these rarities but quietly they are assuming real importance in our field.

Below and to the right—the 70mm cameras offered by nine manufacturers. Vastly different in appearance and performance they certainly are not birds of a feather. What unites them is solely their use of 70mm film, a width equal to that of 120 or 620 roll films. Big enough to spot a missile 350 miles off, 70mm is the widest film commercially available with the sprocket holes necessary for the precise alignment required in many industrial and scientific applications—and the maximum width for whizzing through the camera. Some cameras do indeed whiz their 70mm film through: they can shoot a thousand feet of pictures while you're reading this, with individual exposures to 1/72,000 sec.

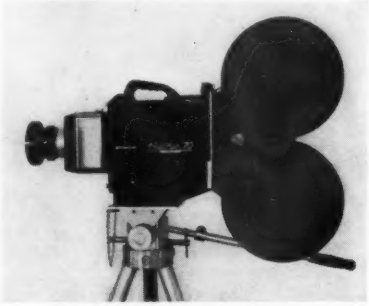
So here they are: cameras designed for big blow-ups, both the detonated and photographic kind, some for rocketry at supersonic speeds, some for reproduction processes, some for press work, portraits, recording, motion pictures—functions public and functions classified.

Because the uses are specialized, most manufacturers design or redesign 70mm cameras to customers' needs. If you'd like more information, PMI will forward your request to the manufacturers of cameras and processing units.

Graphic "70"

GRAFLEX, INC.

An Army Signal Corps special, the Graphic "70" camera is a tough and compact hand outfit made for combat photography, but applicable to many jobs. It takes double-perforated 70mm film in cassettes which provide 50 exposures $2\frac{3}{16}$ x 2¾ in.; a knife cuts off short lengths for immediate processing. Film is transported by a spring-wound motor (10 shots per winding) which cocks self-capping focal plane shutter; T, B, 1 sec. and eight other speeds to 1/500 sec. Rangefinder coupled in interchangeable bayonet mount Ektar lenses.



Hulcher "70" Model 101

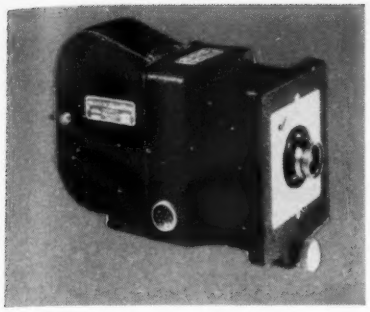
HULCHER "70"

The Hulcher 70mm Press Sequence Camera, using 2¼ x 2¼ format, has sequence rates of 5 to 20 fps, speeds of 1/25 to 1/2880 sec.; uses 100-ft. spools of perforated 70mm film. The Model 100, regularly takes 25 5-in. fps or 50 2½-in. fps.; has variable double rotating disc shutter with exposures of less than 1/1200 sec. possible. The Model 101 takes 100, 400 and 1000-ft. magazines; to 75 fps.; timing lights; electronic speed control. All are driven by electric motors, feature ground glass focusing, are modifiable for special purposes.

Maurer 221 camera

J. A. MAURER, INC.

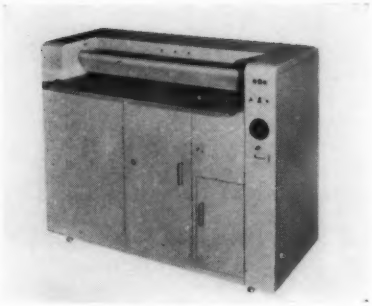
Five models of J. A. Maurer cameras fit in tight spaces of military aircraft and make single or rapid sequence square format pictures of the ground on 70mm film. The model 221 shoots as fast as 1/4000 sec. and incorporates an automatic photocell iris control. The KA-5 does this and ejects processed negative film within 3½ min. for viewing; its weight is under 20 lbs. The P-2, 220 and 221 operate at high shutter speeds from 1/500 to 1/4000 sec., take 15 to 100-ft. 70mm rolls, make sequences as fast as 6 fps, take many interchangeable lenses.



Varitron assembly

BEATTIE-COLEMAN

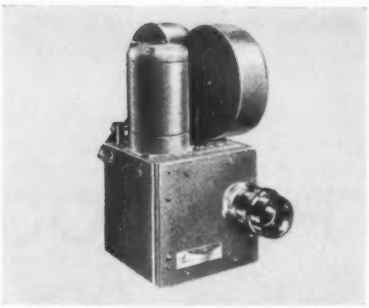
The Beattie Varitron is a data recording system consisting of interchangeable units which can be assembled to do a variety of jobs. There are two film magazines, an adapter back, three camera bodies and three assemblies of lensboard and shutter. The system is automatic: tripping the 1/50 sec. shutter pulses the motor control in the film magazine to advance a frame of 70, 35 or 46mm film. A data recording device is available to count frames, exhibit notes and show time with a 24-hour clock; data is recorded automatically.



Console photocopier

DIETZGEN

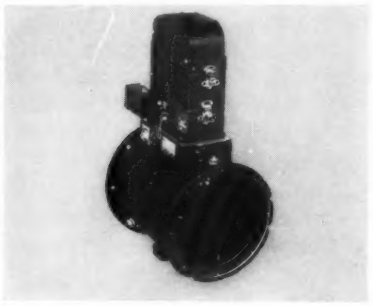
Hardly looking like a camera at all, the Dietzgen Macro-Fax Continuous 70-105mm Camera is a completely enclosed microfilm copier. Documents of any length and up to 42 in. wide are fed onto the table of the machine, pass over an illumination system where they are scanned by a camera and are recovered either from the front or the rear of the unit. Documents are copied at 20 or 40 ft. per minute. Camera takes up to 300 ft. of 70mm film, has removable take-up magazine for short lengths. A number of specified reduction ratios available.



Multidata Model V

FLIGHT RESEARCH

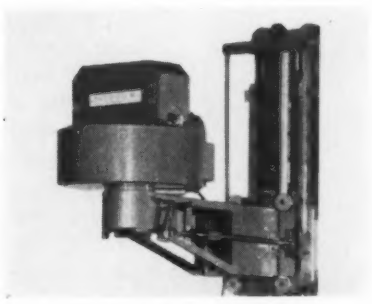
Specifically designed for missile tracking, Flight Research's Multidata Model V 70mm Camera makes 2¼-in. square pictures at 10, 15, 30, 45 or 60 fps. Reciprocating roller film advance reduces vibration potential below that of claw type mechanism. Camera has registration pin frame alignment, zero to 120° variable shutter, lighted fiducial markers to indicate center of aperture to within a thousandth of an inch, lights for visible marks on both sides of film that code time to 1/1000 sec., 400 or 1000-ft. film magazine.



Radar Recorder

OPTO MECHANISMS, INC.

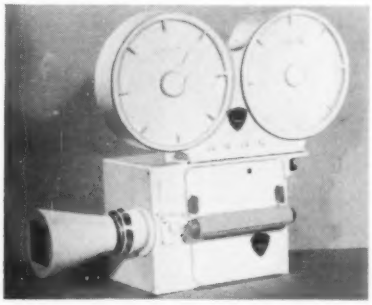
Radar Scope Recording Cameras produced by OPTOmechanisms are used to record the images on cathode ray tubes through a periscope. Film transport is pulsed and automatic; better than 50 fps can be exposed. The model 131 consists of a 10-in. full viewing periscope, a camera body, 50, 100 and 200-ft. 70mm magazines, a control box and an automatic exposure control and focusing device. Model 131A has a 5-in. viewing periscope, 100-ft magazine; 250 and 500-ft. daylight loading; film choppers. Records 24-hour clock, other data.



Auto-focus copier

PHOTO DEVICES, INC.

Photo Devices, Inc., manufactures 70mm cameras on special order, mainly for incorporation in microfilming systems. An example is their Model No. PD90. A finder light illuminates the copy board showing full coverage of the camera, for continuous reduction ratios from 4 to 15X. Camera is raised or lowered electrically, while the focus changes automatically. Exposure control is manual, but a special attachment makes it automatic with photo-electric scanning. Format is 2⅝ x 3½ in. Film magazines can be changed mid-roll.



Rapid recording

PHOTO-SONICS, INC.

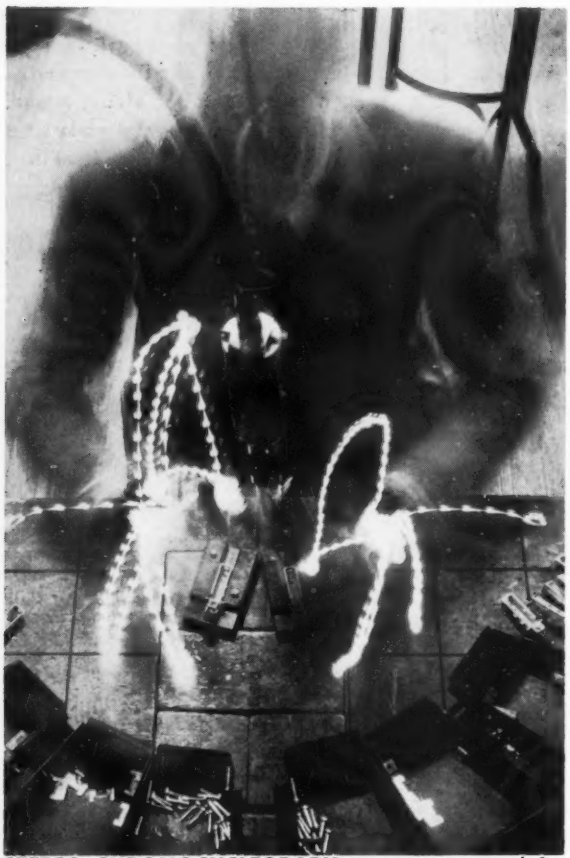
Specific military projects and data recording requirements have dictated the design of the many models of Photo-Sonics, Inc., 70mm motion picture cameras. One model is capable of shutter speeds as high as 1/72,000 sec. at a running speed of 400 fps. It makes pictures a bit more than 1/3 in. high and 2½ in. wide, its capacity is 1000 ft. of 70mm film. Other models have frame sizes to 1.156 in., maximum running speeds of 60 to 400 fps, various drum and disc shutters, capacities of 100 to 1000 ft., automatic marking systems.

CHRYSLER CORPORATION

PHOTOGRAPHY FOR MOTION ANALYSIS

One of the founders of motion analysis, Prof. D. B. Porter of New York University's Industrial Engineering faculty, comments on the use of the camera in the modern-day craft of making work more efficient.

PROF. D. B. PORTER



STEREO CHRONOCYCLEGRAPH is sometimes used for analysis of worker's hand movements. Lights attached to workers' wrists are pulsed at regular intervals, reveal number, direction and speed of movements. Pictures are made in 35mm color stereo so that engineers can construct three-dimensional models of study.

In a windowless room in New York University's Department of Industrial Engineering, a neat row of 16mm movie projectors and a cabinet stocked with film cans form the equipment for the first laboratory for motion analysis in any American college. The ideas spawned in this room have had a profound effect upon engineers, upon industry and, in fact, upon every American. The nub of the concept is simply that you can produce more if you eliminate waste motion. Prof. D. B. Porter, founder of the laboratory, has been influential in forming the techniques of motion analysis. "There's nothing like a picture to show people how a thing works," he says.

Photography, he adds, is at the heart of the system of studying work methods with a view toward making them simpler, more efficient and more productive. Movies and stills train engineers in the techniques of the study itself, and are important ammunition for selling workers on the merit of efficient work systems.

Engineer is boss

The photography involved may not seem to differ a great deal from other jobs the camera takes on in industry, but Dr. Porter insists that to make successful use of photography in motion analysis, the photographer must have a sound knowledge of its essentials. The key man of the team, though, is the engineer.

"The engineer's got to know the job and its requirements intimately before he can set about refining it." When he uses pictures, they must show what he needs to show for his study and he, rather than the photographer is apt to be the

best judge of what is required.

Dr. Porter gives an example: "Suppose the object is to study the work of a group of women in an assembly process. There are plenty of non-photographic factors that can have a crucial effect on the outcome.

"In the first place, it's important to remember that you're dealing with people, who can make or break your efforts. The first thing to do is give the women at least a day's notice that pictures are going to be made. No matter what the pictures are for, they'll resent it unless their hairdo is right." This applies to men as well, Dr. Porter adds.

The pictures must be made unobtrusively, first so that the results are a typical sample of the job involved and secondly, in order that work outside the area under study is not disrupted. For this, Dr. Porter recommends his method of making 100 feet of 16 fps 16mm motion picture film in five minutes flat.

30 sec. of set-up time

The secret, he says, is planning. You arrive at the scene before the plant is in operation, put the camera on the tripod, do your framing and mark with chalk the spot where the tripod will stand. Measure and note down all the distances you'll need for focusing. Canvass the electrical circuits; make light readings. Then remove all your gear.

When the time appointed for making the picture comes, cameraman and assistant divide the equipment and carry it to the spot. While one handles the camera, the other sees to the lights. Except for stops for winding the camera motor, the process should whiz through without interruption. When you're done, go just as quickly as you came. Most workers will not notice the unusual activity at all.

Lighting

Making use of existing light and fast films is likely to be even quicker and less conspicuous, but at times the engineer needs the depth of field possible in close-ups only with both fast films and flood lighting.

Dramatic shadows may add to the impact of a still or motion picture, but they can utterly destroy the usefullness of pictures for motion study purposes, warns Dr. Porter. He himself uses floods at the camera, on both sides of the lens, to kill shadows as much as possible. The results would seem monotonous in an ordinary film, but for analysis purposes nothing may be obscured.

Special motion analysis techniques vary markedly from ordinary industrial movie making practices. Memo motion, used to study the gross movements of a loading dock crew or a production gang, consists of shots made at one second intervals. When projected at ordinary speed memo motion looks somewhat ridiculous on the screen. The figures jump around like jack rabbits. However, in this case the motion analyst is less interested in natural movement than he is in sampling the efforts being spent by each individual at a number of points during the process under study. The use of memo motion can provide him with an automatic, regular sampling, while conserving his time and film. A chart made up from one such film revealed that almost half the time of each individual in a manufacturing crew was spent waiting for other members of the crew to finish their portion of the work. The work has gone on in this inefficient manner for 18 years and only a motion picture revealed the waste. When the study was presented to the gang's foreman, he immediately reorganized the job.

How fast?

Another motion analysis filming technique involves the inclusion of a clock in the study of hand operations. Dr. Porter has made a clock

(continued on page 67)

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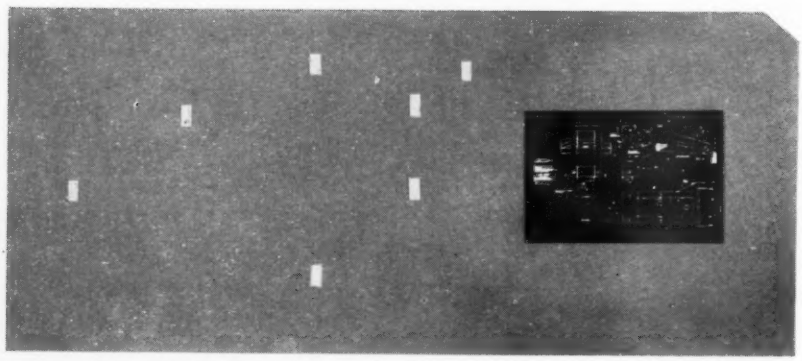
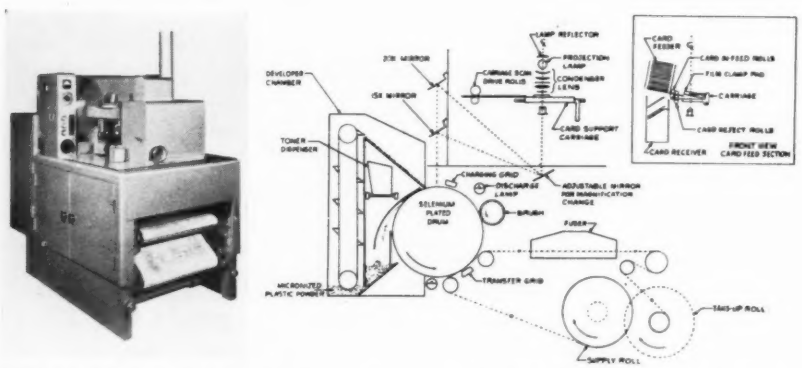
by Herbert P. Paschel

REPRODUCTION AUTOMATON

Some firms run up an annual blueprint storage bill as high as $100,000—but here's a system which reduces engineering drawings to the size of a special delivery stamp, then makes yard-long copies so inexpensively that it's cheaper to make new ones than file old ones!



UNITIZED MICROFILM—Single microfilm copies of drawings mounted in pre-cut apertures of punched cards—minimizes storage space and opens the way for machine filing. Card offers 50 columns for punched data.



XEROX COPYFLO 24" Continuous Printer is loaded with unitized microfilm, turns out a maximum of 400 dry prints, 24 x 36 in., per hour. Controls enable operator to set printer to make 2 to 400 repetitive exposures of a single unitized microfilm card. Diagram, text explain machine's works.

Rocket and missile scientists are not without company in wrestling with space problems. Their own, and other industries whose operations involve voluminous quantities of engineering drawings, have long been plagued with a serious space problem—space for the storage of master drawings, intermediates and blueprints. One large organization, using conventional methods, reports storage space costs of almost $100,000 annually, while yearly labor costs for handling and filing are about triple this amount. Because of bulk and weight, shipping and mailing costs add a staggering sum to the previous figures.

An ingenious approach to this multiple problem combines the speed, economy, ease in handling and space-saving features of three separate systems long in use—microfilming, punched cards and Xerography.

Saves space twice

Conservation of space is realized in two ways. Microfilming reduces the size of the intermediates from which the duplicate prints are made. Xerox prints are expendable. The Xerox Copyflo 24" Continuous Printer produces paper prints at costs substantially lower than the total expense of warehouse space, filing cabinets and handling required for conventional systems. When no longer needed, the prints are discarded.

Interplant shipment of bulky drawings is eliminated. Furnishing drawings to distant plants is achieved by the transfer of microfilm rolls or mounted frames. The cost of microfilm duplicates is low enough to justify creating complete files at any number of points.

Immediate visual reference to any drawing in the master file is expedited by merely viewing the microfilm in a reader.

A high degree of automation is achieved since all of the major operations are performed by fully

automatic equipment and hand operations are reduced to a minimum.

The Naval Bureau of Aeronautics was one of the first to investigate this integrated method. A prototype system was developed at the Naval Aviation Supply Office in Philadelphia. Now in use for several months, the economy and other advantages more than fulfill the expectations of the cooperating organizations.

First step, miniaturization

The first step in the process is the conversion of the master drawings into microfilm images which can be either negative or positive. Positive records are obtained either by initial reversal processing or photographic contact printing. Microfilming equipment used is that of the Recordak Corp. and Remington Rand.

Although the Copyflo printer can make prints from roll microfilm in either 16mm or 35mm size (using an auxiliary attachment), the greatest speed and economy is achieved by the use of individual frames mounted in separate tabulator cards. Standard computer cards are diecut to provide an aperture for a 35mm frame. The Filmsort Automatic Mounter cuts each frame from the roll, locates it on the card and mounts the film in the aperture. Essential data can be entered on the card by key punching, typing and handwritten notation.

An outstanding advantage of the punched card system is the rapid selection and isolation of specific subjects from the master files by machine sorting.

Duplicate Filmsort cards are automatically reproduced in the Filmsort Card-to-Card Printer by a fast, completely dry process (Kalfax). The blank cards have a sensitive film pre-mounted in the aperture. The blanks are exposed, developed by heat and stacked in the same sequence as the masters.

How it works

Prints are made on the Xerox Copyflo 24" Continuous Printer which produces drawings up to two feet wide at a speed of 20 feet of paper per minute. The printer operates on an electrostatic principle that does not require water, light-sensitive paper, liquid processing solutions, intense exposing lights or a darkroom.

The heart of the printer is a rotating, selenium-coated drum which can be repeatedly made photo-conductive by applying an electrical charge. As the drum rotates, the positive microfilm images are projected onto the drum in

(continued on next page)

ONE LENS WITH 3 FOCAL LENGTHS

for Industrial Shots, Architectural Studies, Illustrative and Commercial Photography

Series 1a Triple Convertible Raptar

This photo was made with 13" f/6.8 Series 1a Raptar.

Photo taken from same camera position with rear element alone—focal length 20".

Photo taken from same camera position with front element—focal length 25½".

THE 3-IN-ONE LENS . . . the Raptar Series 1a Triple Convertible is an exceptionally useful lens for commercial photographers because of its large coverage, extreme adaptability and the versatility of three focal length lenses in one. Separate diaphragm scale on front plate for each half of the lens. Focal lengths from 6½" to 25½".

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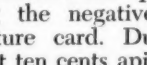

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REPRODUCTION AUTOMATION

(continued from last page)

synchronization. The positive charge on the drum's surface is drained away wherever it is exposed to light. Areas protected from exposure by the opacity in the microfilm remain charged and form a latent image of the original.

A negatively charged plastic powder of microscopic particle size, when cascaded on the drum, adheres only in the latent image areas. Transfer of the powder to the base paper likewise depends upon the electrostatic principle. Prior to contact between paper and drum the paper is given a positive charge. At the time of contact the paper attracts the negatively charged powder from the drum. The application of heat fuses the powder to the paper to form a permanent, smudge-proof positive print. The use of a plastic powder of opposite polarity produces positive prints from negative microfilm.

Repetitive exposures of a single frame, in any number up to 400 prints, can be pre-set on the control panel. The aperture cards emerge from the printer in the order of entry and, being punch-coded, can be machine sorted for filing purposes. Unique print identification is possible with colored paper. A variety of papers are available. Paper feed and delivery is in roll form.

Costs

Precise, detailed costs vary considerably with the type of installation, output volume, size of print, etc. The preparatory steps, microfilming—mounting—duplicating, can be an in-plant operation or purchased from a number of outside service organizations such as the Recordak Corp., Ozalid, Remington Rand, and the member plants of Microdealers, Inc. Thirty to thirty five cents per drawing seems to be the median quotation for a packaged service which includes microfilming, an intermediate positive, and mounting the negative in a Filmsort aperture card. Duplicate cards are about ten cents apiece.

Although a complete installation for the preparatory operations requires a considerable investment, the operating economies become significant with sufficient volume. A precision microfilm machine, such as the Recordak MRC3, costs $5,500, but photographs 580 frames on a roll of film costing $7.25. The Filmsort Automatic Mounter, priced at $32,500, can turn out 2000 finished cards per hour at a material cost of

(continued on page 65)

INDUSTRIAL COLOR

(continued from page 16)

puter which translates the visual corrections into exposure.

Four knobs on the computer comprise the color correction controls used in making the final print. They are built in two stages for first and second correction (if a second stage be needed). Each section has two controls, the first for the hue, the second for the density of filtration indicated by the test print. The corrections are the six additive and subtractive colors and, in addition, the in-between colors. Unique in design, these controls change the basic red, blue and green ratios *without changing print density*. This is a very important factor as anyone who has made his own Type C prints knows.

Once the information is fed into the control panel of the computer, the operator presses a button and the filter wheel on the enlarger lens moves in sequence, giving the Type C paper the proper amount of exposure with each of the three primary colors. It is the simplest color printing method we have seen. You make a few basic adjustments, expose a test print, judge it on the comparator, dial in the information you get from the test, feed in the degree of enlargement, press a button and let the mechanism calculate your exposure for you. The quality of prints from good negatives we have seen made with the Omega system is excellent. The price will be about $2,000.

New color films

Eastman Kodak has announced the availability in May of Kodacolor in 135mm, 46mm and 70mm sizes. Kodak describes this film as a fine-grain high-resolution negative color film. In the middle of May a new size Kodacolor print will also be available. The 2X print (35mm blown up to 2½ x 3½) will sell for 23¢ per print. All the regular enlargement sizes, up to and including 11 x 14 in., will be available from 35mm transparencies. We'll report further on this in a future issue.

At this time we are also testing the new Ektacolor Type L film, which replaces Ektacolor Type B. Balanced for 3200°K exposures, the new film is processed in the C-22 solutions made for Ektacolor S and Kodacolor. The characteristics of Ektacolor L are the same as Ektacolor S for printing purposes, but Type L is intended for long exposures. Although the new film loses speed with long exposures through reciprocity failure, it maintains its color balance. THE END

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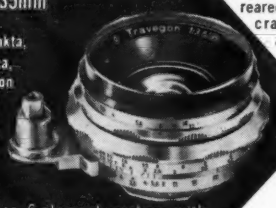

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METHODS FOR TOMORROW

(continued from page 11)

print production have not been overlooked, because LogEtronics Inc. has a new enlarger on the way that will be priced in the $7000 to $8000 bracket. This is their Model D-5, which is claimed to provide faster and more effective automatic dodging than ever before.

Xenon 16mm projection lamps

A highly intense light source other than the carbon arc has long been sought for 16mm film projection. Conventional tungsten filament lamps limit the application of 16mm motion pictures to fairly small halls, whereas many industrial auditoriums rival regular theaters in size or in distance of the projection throw. Mercury vapor lamps provide adequate screen illumination for black-and-white films, but are of no value for color films.

Xenon projection lamps have been successfully demonstrated in America and it is rumored that commercial 16mm projectors equipped with such lamps are now being designed. In England, too, xenon lamps are coming to the front. In the January, 1958 number of *British Kinematography* a recent demonstration of a 16mm prototype projector designed around a new xenon lamp is reported along with a full description of the lamp itself.

The projector was developed by British Thompson-Houston, Ltd. It is actually a standard B.T.H. Model 450 projector with its components rearranged to suit a new lamphouse containing a 2 kilowatt xenon lamp. With the projector running, and using a 2-in., f/1.5 lens, a total screen illumination of 1000 lumens is obtained.

The lamp is said to have a life in excess of 1000 hours. The light it produces extends over the entire visible spectrum, having an equivalent color temperature of approximately 5600K. The lamp reaches full brightness immediately after it is turned on and may be switched on and off at will. Only a small blower is necessary for cooling purposes. Unfortunately the projector will not be commercially available until about July, 1958.

First pictures of atom

On Sunday, March 9 during the CBS television program "Conquest" the first pictures ever taken of an atom were shown. At least this was the claim. I wrote CBS for further details and they confirmed that the pictures were indeed the first ever taken of an atom. They were made by Dr. Erwin Mueller at Pennsylvania State University. After 22 years of effort Dr. Mueller succeeded in developing a method for the controlled release of atoms under extremely low temperatures. As the atoms are released they are "photographed" by means of a field ion microscope, another invention of Dr. Mueller. At a temperature approaching absolute zero the motion of the atoms is greatly retarded, permitting them to be recorded in the field ion microscope, which can produce magnifications in excess of 3,000,000 times.

Reciprocity data

In PMI, Volume 1, No. 1, an article appeared concerning reciprocity failure and its practical implications. Specific reciprocity factors for different films were not given, but obviously these are necessary if a photographer is to make the exposure compensations necessitated by reciprocity effects.

Ansco has kindly supplied reciprocity factors for five of their film products, which are given in Table II below. Table I lists the five films and gives the developing conditions used for deriving the reciprocity data. THE END

TABLE I

CODE	FILM	DEVELOPER	DEV. TIME	TEMP.
A	Commercial Type 206	Permadol	5 min.	68°F
B	Super Hypan	Permadol	6 min.	68°F
C	Triple S Pan	Isodol	6 min.	68°F
D	Super Anscochrome	Normal recommended processing		
E	Anscochrome	Normal recommended processing		

TABLE II

Approximate multiplying factors as a function of exposure time for the Ansco films in Table I.

	FILM				
EXPOSURE TIME	A	B	C	D	E
1/10,000 sec.	1.0	1.0	1.2	1.4	1.8
1/1000 sec.	1.0	1.0	1.2	1.0	1.2
1/100 sec.	1.0	1.0	1.0	1.0	1.0
1/10 sec.	1.0	1.0	1.0	1.0	1.0
1 sec.	1.0	1.4	1.2	1.0	1.0
10 sec.	1.2	2.5	1.8	1.6	1.4
1 min.	1.8	4.0	2.5	2.0	1.8
10 min.	2.5	7.0	5.0	4.0	2.5
100 min.	4.0	13.0	12.0	6.0	4.5

(continued from page 18)

a race. With a long enough focal length you can fill the frame with the images of the horses. But you get a strange illusion. The horses appear to be galloping like mad, as in truth they are. Because of the telephoto effect, however, they seem to be making no progress at all, as if they are on a treadmill.

The zoom lens used at a wide angle can have an opposite effect. Say it is used to indicate that the camera is distant from a group of dancers. When one of the dancers leaps toward the camera it may seem that his jumps are twenty feet long. If a zoom lens is changed quickly from a very short to a long focal length, it may create the unnatural effect of the background rushing to meet the foreground. As a trick it's fine; in normal use however it may have a disturbing effect on the viewer. The zoom lens is usually most effective when used on subjects in a single plane against an unobtrusive background.

Where to get them

The zoom lens is an optical marvel—through optical design it combines many lenses into one, changes focal length at a touch of a lever, yet keeps the image in focus, and the effective f-stop constant. Great credit is due its perfecter, Dr. Frank G. Back, who designed the first of the breed, the Zoomar. The Zoomar for the 16mm camera has a maximum opening of f/2.8 and a focal length range from 25mm to 75mm. With a close-up attachment it can take a field small as 4 x 6 in.

Zoomars with focal length ranges from 22mm to 130mm and from 35mm to 210mm are intended mainly for television work.

Berthiot makes a Pan Cinor in two models: Model 70 is an f/2.4 lens with a focal length range from 17.5mm to 70mm; Model 150 is an f/3.8 lens with a focal length range from 38.5mm to 154mm.

Bell & Howell's new Angenieux Zoom is an f/2.2 lens with a reflex-tvpe focusing viewfinder and a focal length range of 17mm to 68mm.

In the last year the image quality of the zoom lenses has been improved greatly and a former complaint of unsharpness with large openings is no longer justified. The quality of present zoom lenses is fine enough that a number of professionals simplify their equipment by using one zoom lens to replace a number of lenses, when compactness counts. THE END

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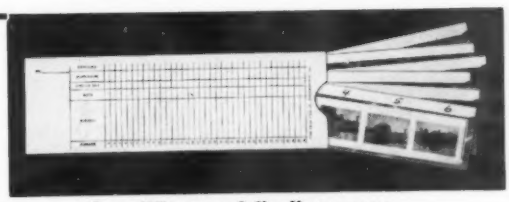

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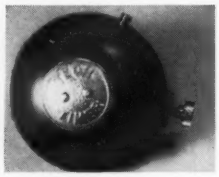

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IN-PLANT TEST

Arnold Eagle tries a workout with new Super Graphic, finds more pros than cons to latest in long line of fine cameras.

SPECIFICATIONS: Super Graphic 4 x 5. Extruded aluminum body, drop bed, forward tilting lens board, revolving back. Integral rangefinder designed to couple with all lenses but 65mm wide angle, through interchangeable cams. Single distance scale serves for all lenses. Shutter release either manual or electrical. Electrical shutter release button convenient to left thumb. All wiring internal, flashgun or speed light plugs into outlet on camera body. Keyhole sockets for Presslok Tripod Mount, as well as conventional tripod socket. Price, with 135mm f/4.7 Optar lens in full sync Graphex shutter, $375.

Arnold Eagle, freelance industrial photographer and Executive Editor, PMI, writes: This newly designed camera is simple enough to fill the press photographer's need for speedy and sure handling, yet has enough new features to satisfy the industrial photographer's need for precision and flexibility. Although streamlined, its shape is not so radically different from the "old box" that it will jar the old timers.

The shutter, operated by a built-in 45-volt BC circuit powered by two small 22.5-volt batteries, can be tripped from the flash gun on the right side of the camera, or by a button on the left side of the body. Of course the shutter can also be tripped manually.

I was happy to bid goodbye to the garlands of wires that used to hang from the older models like seaweed from an old pier. Almost all the wiring is concealed inside the Super Graphic. The box has outlets for direct connection for BC flash circuits having their own batteries, and X-synchronization for electronic flash. I was also pleased with the newly designed Y tripper cord with a double male plug which plugs directly into the body of the camera instead of into the lens board.

Speaking of lens boards, in order to make use of the electric shutter release, lenses must be mounted in a special lens board. Old style lensboards can also be accommodated, but the shutters then must be released in the old-fashioned way.

Another feature that has its drawbacks is the revolving back—which is very handy, except that when it's in the vertical position looking through the rangefinder eyepiece becomes wellnigh impossible. This can be corrected by turning the back 180° so that the slide opening is toward the floor, but if the camera is on a tripod the pan handle may interfere with inserting the holder or removing the slide. With the camera on a tripod it's just as well to focus on the ground glass anyway.

The new front standard, with forward and back tilt, is a long overdue improvement. With the drop bed, rising front, sideway slide, and lateral swing, the Super Graphic becomes capable of a number of corrections. Of course these swings

are not as extensive as those on a view camera—the back has no swings at all—but they are adequate for all but the trickiest correction problems.

A highly ingenious feature, though not exactly new, is the built-in rangefinder system which adapts to lenses of various focal lengths through the use of interchangeable cams (which Graflex either has in stock or cuts to order). Connected with the range finding system is an easily readable footage-and-flash-guide-number scale, on top of the camera where the photographer can see it without twisting his head.

The back of the camera has been fitted with a Graflok type back. The focusing panel and hood slip off easily, permitting the user to clamp in their place a film pack adapter, a Grafmatic cut film holder, a Polaroid back, or a Graphic roll film holder for 120 film.

With the focusing panel on, the back uses regular 4 x 5 Graphic holders. Film pack adapters and Grafmatic cut film holders will work with the back on or off.

The focusing hood has cloth sides, and a clip to hold the dark slide while you are exposing. The focusing hood slips off so that for really fine adjustments the photographer can use a magnifying glass over the whole area of the ground glass. Of course, with the swings in operation, ground glass focusing is absolutely necessary.

While this isn't strictly a feature of the Super Graphic itself, I must say a word in praise of the Press-lok Tripod Mount, a simple and secure gadget which enables one to get the Super Graphic on and off a tripod easily. It is the mount that is screwed onto the tripod. A quick squeeze of two levers and the camera is off (or on). A standard tripod socket is also provided.

THE END

PHOTO INSTRUMENTATION

(Continued from page 13)

of continuous automatic refocusing of 120-in. lenses with information taken from radar range data, and temperature compensation in focusing to correct for telescope expansion and contraction.

"Some of this equipment, surprisingly enough, is on the market. When it isn't available commercially, Sandia develops its own devices in its Optical Development and Tracking System divisions. We find we have to move pretty fast to keep up with aircraft, missile and ballistics observation." THE END

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PHOTO BOOKS IN REVIEW

The Audio-Visual Equipment Directory, *Henry C. Ruark, Jr., Director of Information, NAVA, Editor. The National Audio-Visual Association, Inc., Fairfax, Va. $4.25.*

Perhaps only someone familiar with the problems of editing can fully appreciate the excellent job of organization and presentation that went into the making of the fourth edition of this basic guide to all current models of audio-visual equipment.

The book contains listings, photographs and up-to-the minute specifications of more than 500 different models of 16mm motion picture projectors, magnetic and optical; filmstrip projectors; slide projectors, from single frame to 3¼ x 4; opaque and overhead projectors; automatic continuous still projectors; repetitive tape equipment; magnetic tape recorders and playbacks; record and transcription players; projection screens; mobile projection stands and tables; storage cabinets; film library equipment and accessory items of all kinds. Prices of all equipment are included, as well as special feature notations.

New features in this edition include a section on reading and tachistoscopic devices and an enlarged section on closed-circuit television equipment.

Radiography in Modern Industry, *Second Edition, Eastman Kodak Company, Rochester, N. Y., 140 pages, illustrated, $5.00*

This excellent new text on the uses and techniques of radiography in non-destructive testing inspection may well be regarded as the handbook in the field.

It is a clearly-written exposition of the use of X-rays and gamma rays in discovering hidden flaws inside materials and products. One hundred and twenty illustrations and tables increase the book's lucidity. New data on radioactive isotopes, geometric enlargement, image amplification and radiation monitoring appear in this second edition of this basic text.

Topics covered are: the radiographic process, X-rays and gamma ray sources, geometric principles, factors governing exposure, radiographic screens, arithmetic of exposure, sensitivity and detail visibility, Kodak industrial X-ray films, processing, the processing room, special technics, sensitometric characteristics of X-ray films, protection of workers and the reasons for unsatisfactory results.

AV Instructional Materials Manual, *James W. Brown & Richard B. Lewis, Editors. 192pp. The Spartan Book Store, San Jose State College, San Jose, Calif.*

Intended primarily for classroom instruction in teacher-training courses, this workbook is nevertheless a gold mine of AV information for newcomers to the field and those who wish to broaden their familiarity with new techniques.

Its 192 pages form 55 work projects and checksheets covering the many skills and problems involved in selection and presentation of material that must be seen as well as heard. In terms of actual AV work this means beginning with simple sketching and layout, through handmade lantern slides, transparencies, ammonia process, use of still and movie cameras and operation of all types of projectors and sound equipment.

When the authors—there are 10 of them—reach their sections on operation of complex equipment they don't set out to replace the manuals provided with the machines, but to supplement them with actual on-the-job exercises. Careful use of these drill methods will result in formation of fast, efficient routines to give AV sessions the pace and finish of professional performances.

Though necessarily brief, the worksheets on still and motion picture camera operation are remarkably sound. Far from superficial, they are obviously the work of a practical camera-user.

by Bernard Hoffman

QUESTION & ANSWER

QUESTION: I am trying to photograph the fluorescence of mineral and rock specimens in color and black-and-white for a geological survey project. Although I am using an ultra-violet (black) light source and an ultra-violet filter over my lens, my results are consistently poor. The specimens fluoresce beautifully to the eye while the background remains jet black, but I can't seem to achieve this effect on my film. What I wind up with is a weak, washed out fluorescence and an overlighted obtrusive background. How can I reproduce what I see?

ANSWER: Try using a wratten K-2 filter over your ultra-violet filter. The combination of these two filters usually does the trick. This should drop out all undesirable background an enhance the billiance of the fluorescence. A K-1 filter might also do the job but its effect will be slightly weaker.

I trust that you are using ultra-violet protective glasses during these exposures. Overexposure to ultra-violet light sources can cause blindness by burning the sensitive retina of the eye.

I noticed in your March column that Mr. Ernest Miller wanted an easy method of writing data on the face of glossy photographs.

We have always found it quite easy to mark on the border area of a print with a soft lead pencil, providing the area of a print is rubbed with an eraser first.

I enjoy your column very much.

—Donald Freeman, Akron, Ohio

QUESTION: We have spliced together parts from old silent 16mm films of our products. Although the footage was shot at 16 frames per second, we find that the film projects nicely at sound speed, 24 frames per second. Does it make sense to add sound to this film?

We would also feel more secure when we begin taking a longer film if we knew what the generally accepted time should be for long shots, medium close-ups and close-ups.

—Allen J. McNitt, Keene, N. H.

ANSWER: Generally speaking, 16mm film exposed at 16 frames per second should not be projected at 24 frames per second. The fact that your silent-speed footage does look normal projected at sound speed indicates to me that the movement involved is somewhat abstract. If such familiar motions as people's walking or talking were included the hastening of action would be laughably obvious, like the old Keystone Cop movies. As long as your movies look natural, however, I see no reason against adding sound at the sound speed. Magnetic sound, by the way, can be added at either speed—but once added it is definitely not interchangeable.

The second part of your question is more difficult to answer because scene length is so much a matter of taste and judgment. It depends on the scene in particular and its relationship to the film in general. The rule, many times more honored in the breech than in the observance, is that you allow more time for the long shot, while the audience gets its bearings, and shorten the scenes when you move in close. Three seconds might be too long for a certain static close-up. Twenty seconds might be too short for another one that shows, for example, the complex movements of a very interesting mechanism. It's usually a good idea to shoot more footage than you intend to use and have an experienced editor trim the unnecessarily long sequences. THE END

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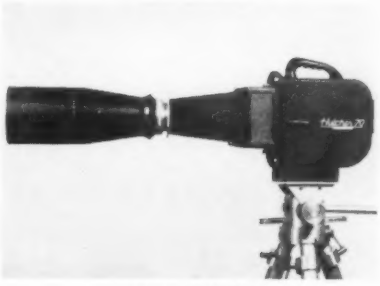

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AUDIO-VISUAL

Outdoor Projection **202**

Genarco Inc. 8-page booklet complete with illustrations, tables, details on wiring, protective housing and permits, tells how to utilize outdoor projection of giant images.

3-D Sales Aids **203**

Realist, Inc. 16-page booklet contains case histories on use of stereo photography in selling products and services for a variety of industrial and business organizations.

CAMERA & LENS

Cine Theodolite **204**

Perkin-Elmer Corp. 8-page brochure on the Kth 57 cine theodolite describes the performance and specifications of this motion picture missile tracking system.

EQUIPMENT

Paper Cutters **205**

Laukhuff-Pratt Mfg. Corp. Price list describes Universal all-steel trimmers in sizes from 16 to 36 in. and accessories including foot operators and special guide stop attachments for darkroom use.

Stainless Steel **206**

P & H Sales Corp. 16-page catalog of stainless steel sinks for photographic and laboratory use, jacketed developing tanks, print dryers and darkroom accessories.

Darkroom Supplies **207**

States Smelting & Refining Co. 24-page catalog lists plastic beakers, bottles, buckets, funnels, tanks, floating lids, piping, tubing, siphons and other darkroom and laboratory supplies; includes section on Tamco silver reclaiming equipment.

Color Costs **208**

Arkay Corp. 6-page cost analysis estimates equipment, material and labor costs for color processing.

Water Filters **209**

Commercial Filters Corp. Literature on honeycomb filter tubes to remove impurities as small as one micron from darkroom water supply.

Beseler Enlargers **210**

Charles Beseler Co. Specification sheets give complete descriptions, prices and accessories for Beseler enlargers.

SUPPLIES

Photos on Metal **211**

Metalphoto Corp. 8-page catalog and price list gives details on photosensitive anodized aluminum plates and developers, fixers and toners for processing photographs on metal.

Color Retouching **212**

Eastman Kodak Co. 6-page insert on how to retouch color negatives with regular black pencils or colored pencils. Recommends equipment and gives detailed descriptions of how to overcome common defects.

Plastic Binding **213**

Tauber Plastics, Inc. 36-page price list and catalog complete with samples, details on the use of plastic tubes and binding equipment for sheets and booklets.

GRAPHIC ARTS

Lettering Machine **214**

Filmotype Corp. 6-page folder describes the Filmotype Photo-Composition Machine which reproduces 1000 styles of hand lettering and display type on photographic paper or film.

Test Pattern **215**

Copease Corp. Test pattern features facsimile reproduction of 12 examples of copy from pencil writing to spirit duplication which office copiers are often called upon to reproduce.

Lighting Standard **216**

Macebeth Corp. 4-page technical bulletin outlines a standard of illumination for color matching and color quality control in graphic arts. It contains illumination curves and information on the techniques of viewing color materials for consistent results.

MOTION PICTURES

Sound Effects **217**

Major Records. 26-page catalog lists 1,232 records of music and sound effects from Broadway plays.

Cine Service **218**

Western Cine Service, Inc. 20-page price list offers information on 16mm color and black-and-white processing, duplication, editing, music and effects; gives 16mm equipment rentals and prices of 16mm sensitive materials available through this Denver firm.

SERVICES

Custom Color Service **219**

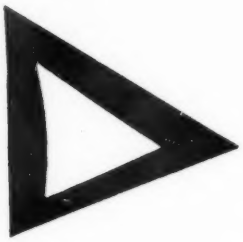
Rapid Color Print Co., Inc. 19-page price book lists 12 catagories of color processing from copy prints to color filmstrips offered by this California firm.

Photo School **220**

New York Institute of Photography. 40-page illustrated booklet outlines training available in various branches of photography at the school.

How to Use Color **221**

Meisel Photochrome Corp. 5-page information sheet answers questions of industrial and commercial photographers interested in adapting their techniques to transparency and negative-positive color work.



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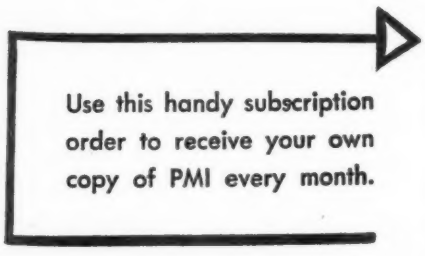

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NEW PRODUCTS

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New Miranda "A" 116

The new Miranda "A" 35mm automatic single-lens reflex camera permits the use of lenses and accessories of Exakta, Exa, Pentacon, Praktica, Consul, Hexacon and other cameras, with adapters. With an adapter for close-ups it takes Leica, Canon, Nikon and Contax lenses.

The camera features an interchangeable penta-prism viewfinder that produces a 1:1 image, a focal plane shutter with speeds from 1 to

1/1000 sec., single-stroke film transport shutter cocking; built-in flash and electronic flash synchronization, a new slow speed setting knob, an interchangeable lens mount and a rapid rewind lever. Prices: with a 50mm Soligor f/1.9 automatic lens, $259.95; with 50mm Soligor f/1.9 pre-set lens, $229.95; case, $14.95; camera body only, without lens, $174.95.

New Bolex Lenses 114

Three new lenses have been designed by the Som Berthiot Co. for the Bolex H-16 Reflex motion picture camera. They are being distributed by Paillard Inc.

A wide-angle, nine element 10mm Cinor f/1.9 is $119.50. A six element 25mm Cinor f/1.4 is $131.50. A telephoto, six element 75mm Tele-Cinor f/2.5 is $89.50. (Federal Excise Tax is included in prices.)

Projector-Screen Combo 104

Salesmen and other users of 16mm sound motion pictures can carry a sound projector, screen and a 2000-ft. reel of film with them in a single luggage case resembling a two-suiter. The unit, Triangle Projectors Inc.'s Professional Two-in-One, incorporates a Bell & Howell Filmosound 385 optical sound 16mm mechanism and 15-watt amplifier, an 18 x 13-in. rear projection screen, an 8-in. speaker and an extreme wide-angle 14mm lens in a grey plastic covered case, 18 in. high, 10 in. deep and 25 in. long. Price of the Two-in-One projector complete: $698.50. Optional equipment available: a larger rear projection screen, 18 x 24-in., $49.50; a 2-in. Bell & Howell Super Proval lens for front projection, $37.50. The unit can be furnished with the Filmosound 302 magnetic recording projector mechanism.

New Transistor Flash 121

Two new American Speedlight Corp. units provide 100 and 200-watt-seconds of electronic flash power in units weighing only 3½ and 5 lbs, respectively. The 100-watt-second B422 and the 200-watt-second B423 operate on AC, "D" cells or rechargeable nickel cadmium batteries. Both employ transistors for economy in weight and size. Other features of the new units include: injection molded cases; push button controls for full, half and

quarter power; double light connectors; interchangeability with existing Ascorlight units.

Price of the 422 assembly (power supply, lamp and power cord) is $139.50. Price of the 423 assembly is $196.50.

Kodak Pageant Sound Projector

The Kodak Pageant Sound Projector, Model 8K5, has an 8-watt amplifier with a frequency reponse of 5 to 7000 cps and a 6 x 9-in. speaker housed in a baffled inclosure. The amplifier is designed around printed circuits. A tungsten carbide toothed pulldown claw provides maximum hardness and wearing qualities. A Kodak Ektanon 2-in. lens is standard equipment, but projector also accepts 1½, 3 or 4-in. projection lenses or the Cine-Kodak Bifocal Converter for 1⅝ or 2½-in. lens effects. Although a 750-watt lamp is provided with the projector, a 1000-watt lamp may be used. The projector's wooden case has a textured tan finish, gold anodized speaker grille, metal corners and banding. Other features include: 2000-ft. film capacity, sound and silent speeds, folding reel arms, oil-impregnated bearings and nylon gears that need no lubrication, 25-ft. speaker cord and 8-ft. power cord. Price of the Pageant is $429.

Graphic Arts Printer 112

An enclosed 75-amp arc lamp is reflected to cover the entire 30 x 40-in. surface of the vacuum frame built

into the new RP-40 Rapid Printer, produced by the nuArc Co.

The vacuum frame of this plate-exposing device can be loaded in the conventional face-up manner. The glass lifts, allowing the plate and the negative to be positioned. Then, by operating a release knob, the entire vacuum frame reverses to a face-down position for exposure.

Finished in baked silver hammerloid, the RP-40 fits in a 40 x 50 in. floor space. It operates on 220V 60-cycle AC. Price, including crating: $695.

Improved Whiteprinter 120

A modified and improved Printmaster 810 for the reproduction of engineering and architectural drawings has been introduced by the Ozalid Division of General Analine and Film Corp. The whiteprinter accommodates materials of any length up to 42 in. in width. Printing and development speeds are synchronized at 40 ft. per minute. Improved visibility in the feeding mechanism, conveniently placed controls and

NEW PRODUCTS

(continued from last page)

a brush feed assembly increase the efficiency of the system. A tracing release pedal permits the operator to straighten a tracing and print going through the machine without loss of time or material. The unit copies two-sided papers, block-outs, coated materials and foils.

High Speed Lamp 109

A new high intensity Xenon lamp for high speed photography uses a quartz bulb only .197 in. in diameter and produces illumination corrected for use with daylight color film (5700K). A cold light source, the lamp can be pulsed at 7,500 watts with the light focused at maximum spot on a person's face without discomfort from its heat. The unit is made by the Fastax Division of Wollensak Optical Co.

Movie Power Packs 119

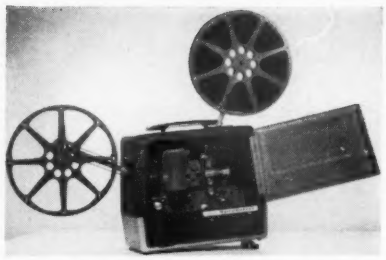
Two new portable camera packs for motion picture cameras have been introduced by the Dormitzer Electric and Manufacturing Co., Inc. They incorporate Dynaseal rechargeable batteries which supply full voltage until discharged. The

DY-1014 is a 7½-volt pack; the DY-1015 is a combination 15 and 7½-volt unit. Both have indicating meters; receptacles to adapt to most motion picture cameras. The DY-1014 is $124.50; the DY-1015 is $192.50.

New Filmosound 106

Bell & Howell's latest 16mm sound motion picture projector has a safety interlock that automatically disengages the rewind gear when the film is removed, preventing the projector from being started accidentally when a new film is shown. Another feature of the new Filmosound Specialist 399 is factory-sealed lubrication for each moving part. Parts that get heavy wear—the shuttle, film guide rails and side tension clips—have sapphire jewel insets bonded to the metal parts.

The Filmosound Specialist 16mm optical sound projector with a 15-watt amplifier and an 8-in. speaker



in a single case is $499.95. Other amplifier-speaker combinations and a number of optional features are available at higher prices.

Sound Reproducer 105

A new Magna-Tech optical and magnetic reproducer is the type OMD 135, a double flywheel system with a heavy Mu-metal shield covering the head and sound drums. An optical reproducer portion, on a separate panel, can be added to the unit. Other features include the use of stainless steel on all vital parts, no lubrication required on moving parts, a rewind time of less than one minute for a 2000-ft. reel, a single panel control, maximum film capacity of 5000 ft. of 35mm film.

Kodak Automatic Slide Projector

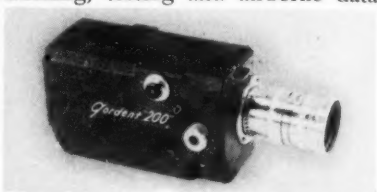
The Kodak Cavalcade slide projector offers completely automatic, semi-automatic and manual slide changing, and a new idea in slide magazines.

For additional information on any new products item, circle the appropriate number on the readers service card attached to page 59

With the projector set at automatic, time cycle between slides can be set at either four, eight or sixteen sec. intervals. The semi-automatic slide changing arrangement can be operated at the projector or by a 12-ft. push button remote control cord. An advance wheel at the side of the Cavalcade provides manual operation and the wheel can also be used to advance or reverse the slide sequence even with the projector on automatic. Slides are pre-popped by a duct of warm air passing over them. Slides go into individual steel protectors before insertion into the magazine, and warped or frayed slides may be shown without danger of jamming the machine. A Kodak Projection Ektanon 5-in. f/2.8 lens is standard equipment, but 4 and 7-in. f/3.5 lenses are available. A knob allows critical focusing down to 4 ft. Other features are: 13 x 12 x 7-in. plywood carrying case covered with grey fabric, movable pointer, elevation from 0 to 9 degrees, leveler knob and easily removable condensers and reflectors. An accessory condenser is available for super slide projection. Price of the Kodak Cavalcade slide projector is $149.50. The 40-slide trays cost $4.75 per pair and the 30-slide trays $4.50 per pair.

High Speed Camera 108

A new 200 fps 16mm high speed camera, the Gordent "200," takes a 50-ft. pre-loaded 16mm film magazine. Designed for use in missile tracking, testing and airborne data



recording, the Gordent operates on a 28 volt DC electric motor. It weighs 2½ lbs. Offered by Gorden Enterprises, who supply a special high-speed magazine for the camera, it accepts all "C" mount lenses.

16mm Recording Camera 118

A 16mm intermediate high speed camera with a 200-ft. film capacity is now available from the Photo Instruments Division of the Benson-Lehner Corp. The new Model HS-16A Photographic Recorder uses an intermittent walking claw type movement. Co-axially mounted daylight-loading film spools reduce the space required by the camera body. Timing lights, boresight, camera mount, "C" mount lenses, carrying case, interchangeable shutters and speed change gears are available.

35mm Enlarger 117

The Accura 35mm enlarger can be disassembled to fit into its wooden carrying case which serves as the enlarger base. Other features of the new enlarger are: a double condensing illumination system; rack and pinion focusing; a glassless carrier for single 35mm frames; an f/3.8 2-in. clickstop lens, an adjustable easel and a parallelogram support lamp house and lens assembly. Price: $59.95.

Silver Recovery 101

Claimed to be 95 per cent effective in recovering silver from hypo, a new unit has been announced by the W. B. Snook Co., Inc. Called the Rotex Hypo Recovery Unit, its other advantages are said to be portability, compactness and the unit's ability to extend hypo life by as much as eight per cent.

PHOTO METHODS IN USE

EXPLORER I MAKES SCREEN DEBUT WITHOUT RETAKES

About 11 p.m. on the last day of January the United States succeeded in getting its first baby moon headed into interplanetary space.

On hand to watch the Army deliver the goods from Cape Canaveral were a number of precision cameras which recorded the take-off of Explorer I in uncanny detail. Part of one of the series of pictures made is reproduced on the cover of this month's PMI—done with a Flight Research Incorporated Multidata Model V 70mm Tracking Camera *(see 70mm directory, page 44).*

It was set off in synchronization with the rocket firing by remote, automatic control.

The shuttering system of the camera resembles that of a professional movie camera. The film transport, however, differs from the conventional, claw system. Substituted are a group of sprockets mounted on rocker-like arms; they need move but a short distance compared to a claw mechanism. No vibration inducing forces occur during the actual picture taking cycle. Another refinement is a servo loop which phases the camera mechanism so that the mid-point of the shutter opening occurs at the same time as a master time signal is pulsed.

At this precise timing (within a millisecond accuracy) two other things occur. First a flash lights to expose reference markers on the edge of the film. Secondly, a reference signal is fed to auxiliary instruments to record the time of the exposure.

In rocketry "that one 'first take' has to be right," the manufacturer of the camera says, "because there can't be any second tries." The 70mm size, they add, increases the reliability of camera takes. Blow-ups can be made much larger and lenses can be used which far extend the range of the camera, but which allow leeway for getting the image off center yet still in the picture.

The original negative of the cover shot was made on Linagraph Shellburst film drawn through the camera vertically (PMI's artist fitted the strip into the layout horizontally) at 10 fps, and bore the fiducial reference markings along the edge of the film.

The lens used was a 20-in. Kodak Aero-Ektar at f/8. Shutter was at a 45° opening. The camera mount was 2,000 ft. from the subject.

THE END

NEW PHOTO LIBRARY

A few weeks ago the Minnesota Mining and Manufacturing Co. announced that they had purchased the Mertle Collection for their Central Research Laboratory in St. Paul, Minnesota, and that it would be available to qualified students upon request.

This decision of the 3-M Company to open the Mertle Collection for study by those interested in the history and development of graphic arts processes is indeed fortunate, because libraries specializing in these areas are rare. This particular collection is said to be the largest of its kind ever put together.

Here are some statistics on the collection. It contains more than 6000 volumes of books and bound periodicals, most of the U. S. patents on graphic arts, and thousands of clippings and special articles on processes and methods. In addition there are examples of hundreds of reproduction techniques, portraits of inventors and biographical data, plus rare original printing plates, etc. Also included are the business records and early correspondence of Max Levy, pioneer manufacturer of halftone screens, the private correspondence of Edward Epstean, American photohistorian, the scrapbooks of Frederic E. Ives and many others. —LLOYD E. VARDEN

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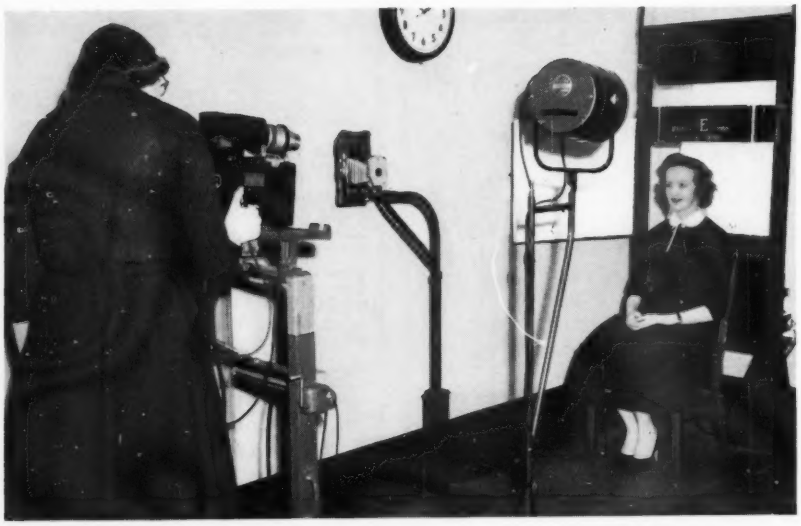
Get more information. Circle 415, page 59

What happens when a bunch of high-powered engineers tackle the old problem of a foolproof identification setup? This versatile, portable, tamper-proof layout is the answer found at New York's Bell Laboratories.

ID FOR UNTRAINED STAFF



ALL THE PHOTOGRAPHIC DEPARTMENT has to do with this arrangement is to change magazines on the Beattie Portronic 70mm portrait camera and develop the results, which are laminated to form the employee's badge. The Polaroid Land Camera swings into position to make "picture-in-a-minute" for use on temporary pass. Backlighting is operated by micro-switch under seat pad; camera release operates strobe light and exposure counter.

GUARD RINGS fit over lens and shutter controls to prevent accidental upsets. Screwdriver is needed to change aperture or shutter speeds, a deterrent to the officious amateur who thinks he knows better than the photographer.

ADJUSTABLE HEADBOARD carries pertinent information in changeable celluloid letters. Even background illumination is secured with matte white plywood board set slantwise and lit with four incandescent bulbs.

An avalanche of identification pictures coming unexpectedly can tie up a photographic staff in unskilled labor and wreck the most flexible work schedule.

This is the problem that faced Dick Haard, Manager of the Photo Department at the Bell Telephone Laboratories, when for military security reasons the pictures on Bell Labs employees' badges had to be brought up to date. What was needed was a rig with which the Personnel Department could do the routine button-pushing, the drawn-out task of shepherding the employees to the studio and the necessary record keeping. The Photo Department was ready to do the developing and printing.

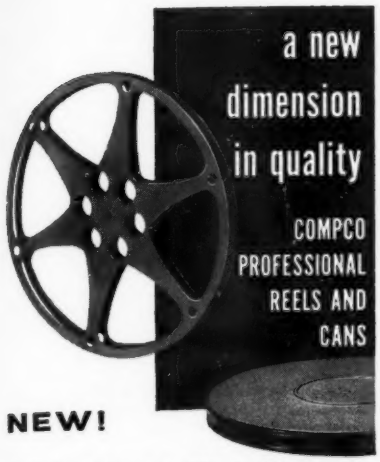
The system was evolved by the Photo Department together with some of the engineering talent abundant in the laboratories. It shows the influence of electronic practice in that the headboard and backlighting assembly is built on a "rack" such as is used for radio and telephone equipment.

Shadowless background

On this rack a series of bolt heads projecting from the uprights support the adjustable headboard, while behind the uprights a slanting sheet of plywood, painted matte white, forms a white, shadowless background. Background illumination is provided by four 200-watt frosted bulbs, two above and two below. These are controlled by a relay which is activated by a micro-switch located under the pad on the chair provided for the subject.

The business end of the apparatus consists of a Beattie Portronic 70mm camera and an electronic flash unit. A thumb release is on a flexible cord. Pressing the release not only operates electronic flash and shutter, but also advances the film and trips an exposure counter mounted under the camera stand.

Aperture and shutter speed were adjusted when the equipment was installed, but it was soon discovered



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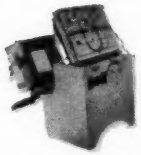

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that settings had a way of wandering away from the correct point. This was remedied by fitting a guard ring over the lens, to prevent accidental knocks and discourage unskilled tampering.

As security measures are stringent, it was necessary to provide new employees with a temporary pass with a picture without waiting

MICRO SWITCH ASSEMBLY is housed on panel hidden under pad on subject's chair. Weight of subject closes switch, which turns on background light by activating relay *(right)*. To maintain proper focus chair is bolted to flooring panel.

for the entire magazine to be shot and developed. This problem was solved by providing a Polaroid Land Camera on a pivoted arm, which swings into position, makes a picture in a minute and swings out of the way again. THE END

REPRODUCTION AUTOMATION

(continued from page 50)

less than 4 cents per card. A much lower priced, manually-operated mounter is available. The automatic Card-to-Card Printer, which rents for $650 per month, likewise has an hourly output of 2000 cards. Blank cards, with sensitive film premounted, cost about 6½ cents each.

The Copyflo 24" Printer rents for $3,000 per month and has a rated maximum capacity of 400, 24 x 36-in. prints per hour. A reasonable average cost for operating supplies (paper, powder, etc.) is about 1½ cents per square foot of print. This would total about 9 cents for a full size print. To this, as with the other machines described, must be added the costs of labor, space, and machine rental (or depreciation).

Stations having only an occasional demand for prints will soon be able to make their own, on the spot, from the Filmsort cards, by means of low volume, low cost, automated Xerox equipment. Maximum print size will be 18 x 24-in. THE END

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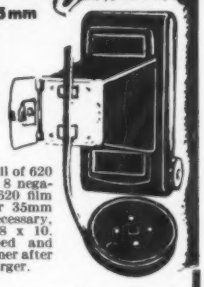

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IN-PLANT TEST

Handy, adaptable and beautifully built, is aircraft plant photog's verdict on Mamiyaflex interchangeable-lens reflex.

SPECIFICATIONS: Mamiyaflex Professional C Interchangeable Twin-Lens Reflex 2¼ x 2¼. Lenses available: five-element Mamiya Sekor 80mm f/2.8; four-element Mamiya-Sekor 105mm f/3.5; three-element Mamiya-Sekor 135mm f/4.5. Seikosha MX shutter with speeds 1 to 1/500 sec. on each lens set supplied.

William Lowenstein, Chief Photographer, Republic Aviation Corp., Farmingdale, L. I., writes: Two big features make the Mamiyaflex particularly suited for industrial use: focusing to seven inches plus interchangeable lenses. As far as I am concerned, the camera is loaded with good features, with only here and there a characteristic which, in view of the high standard set by the manufacturers, proved—well, slightly disappointing.

To begin on the credit side, I was extremely impressed by the fine construction of the camera. Aircraft machinists have to be pretty good, and I showed the Mamiyaflex to one of our top men in that field. He agreed with me that the metalworking was excellent: the front standard rigid, the track smooth, and the action velvety. This front standard rigidity is particularly gratifying since twin-lens reflexes have been known to develop a lot of play when racked out.

The loading was convenient due to the removable back, and although it isn't too serious a matter, I was pleased to see the accurate, consistent spacing between negatives, as an indication of the fine tolerances to which this camera is built.

Interchangeable lenses sounds like a good sales point for a twin-lens reflex, but unless the lenses can be changed quickly and easily, without too much work, there is not much point to the feature. Happily, the interchangeable lens system on the Mamiyaflex is fast and simple, making this outfit one of the most flexible on the market.

Another great convenience is the long bellows, which permits focusing the Mamiyaflex to as close as 7 in. with the 80mm lens. At this distance the parallax problem gets dangerous, and no less dangerous is the problem of exposure compensation with bellows extension.

The design of the camera has taken both of these problems into consideration, and come up with very practical solutions. On the bellows bed there is an exposure correction scale that tells what allowance to make for extra racking out—and also refers to lines engraved in the ground glass that serve as a guide to parallax correction. This sounds more complicated than it is in use, but there is little ground for complaint since most parallax correction devices—for these short distances, anyhow—are even more complicated.

For tripod use there's a gadget called a Paramender, which takes care of the difference between what's seen with the viewing lens and what comes through the taking lens. This is a handy accessory for photographers who can take their time with setups; for those of us who work on the run it's just one more encumbrance to think about. Incidentally, the field lens transmits a really brilliant image.

When changing lenses a small baffle fits over the film. This must be done with a control knob. It is not automatic. What is automatic, though, is a red semaphore that appears under the ground glass to warn you when the film is baffled, a very good idea since once the lens is changed one is apt to forget that there are things to be taken care of inside the camera.

The Mamiyaflex is a bulky camera, but this is somewhat offset by the grip holder accessory. The grip holder is very useful but I would have preferred it with an adjustable strap instead of the one it has.

The lenses produced acceptably sharp pictures at full aperture but the definition improved considerably when stopped down, which is where they will be most useful anyway.

The viewer hood and magnifier didn't work as smoothly as the rest of the moving parts, but this is hardly a crucial point.

Potentially the Mamiyaflex is an excellent all-round camera. It is built to a wonderful principle: interchangeable lenses with the convenience and accuracy of a standard twin-lens reflex. Even more convenient is its ability to focus down to 7 in. with the normal (80mm) lens. This makes it extremely useful for close-quarters work, and a particularly good feature in a camera for industrial photographers.

It is my opinion that the good features of the Mamiyaflex are good enough to outweigh whatever criticisms I have found to make. In most cases my criticisms had to do with relatively minor constructional faults, which, I am sure, will be corrected in future models of this exceedingly well-designed piece of equipment. THE END

PHOTO DEPARTMENT ANALYSIS

(continued from page 35)

The black-and-white film used is predominantly Tri-X, rated at 500, developed in Plymouth Products Ethol UFG for 7 to 7½ min. UFG was chosen because the Goodrich men have found it to give good grain characteristics and shadow detail and it's fast.

Fixation is in Heico NH5, which clears in one minute and fixes in three to five. Small Nikor tanks are used, in a thermostatically controlled water jacket.

Ansco papers are used, and since the staff prefers to use the developer made to match the paper emulsion, they are developed in Ansco Vividol. After a dip in a glacial acetic acid shortstop the prints are fixed in five minutes in Hube Briers' paper hypo —a brutal solution of 45 lbs. of crystals in 7 gals. of water. Prints are then thoroughly washed—not surprising—and before going onto the glossy drier are soaked in the usual glycerine and water to which a dollop of wetting agent has been added. This gives a better gloss and prevents the prints from sticking on the drier drum.

There is one other BFG money saver that deserves to go on the record. For most of their posed advertising and publicity pictures they don't hire models, but draft pretty girls from the office or plant. These girls are called "Siberian help." THE END

MOTION ANALYSIS

(continued from page 47)

which reads in 1/2000 sec. intervals, called in motion analysis terms a "wink." Though the split second timing is important for observing tiny sections of manipulation under study, high speed filming is seldom necessary. Shots of 16 fps are usually fully adequate, with 64 and 128 fps called for only on rare occasions.

The split-frame technique has compelling advantages for motion analysis. One of Dr. Porter's films contrasts a worker using ordinary shop methods on the right half of the screen with the same worker using both hands in a symmetrical rhythmic way—which is often the basis of efficiency—on the left half of the screen. The task was completed in the "efficient" half of the screen when it was only half done in the inefficient one. The lesson was obvious.

Dr. Porter emphasizes that efficiency methods require cooperation from every level of labor and management. They can be imposed from above only with great difficulty. The most efficacious way of applying efficiency methods is by interesting all involved, then encouraging production workers and foremen to initiate the request for a particular motion study. Often a picture of those involved is of great help in promoting initial interest. The last warning from Dr. Porter: "If a print is promised, make sure that it's delivered." THE END

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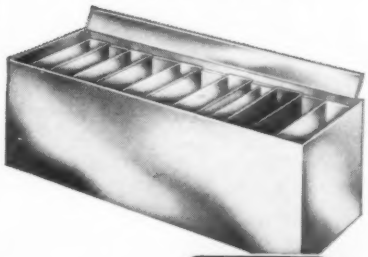

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Copy must be received before the 10th of the month preceding desired issue (example: April 10th for May issue which is mailed early in May). Please print or type copy.

SERVICES

SLIDEFILM LAB: Dump the job on us! We'll turn out a filmstrip you'll be proud to project. All we need is your transparencies or art, we shoot masters, titles, and do fine color release printing. Custom Film Lab, 1780 Broadway, NYC

MOTION PICTURE PROCESSING

16 mm reversal film processing and duplicate prints. Xpress service seven days weekly. Send for prices. Cine-O-Tone, 624 So. Michigan, Chicago, Illinois

CAMERAS, ACCESSORIES FOR SALE

LINHOF Super Technika III 4x5, Symmar f:5.6/150, new list—$499. Special—$300. Wahl Arms Co., Bogota, N.J.

CAMERA REPAIRS

FOREIGN—Domestic Camera Repairs—15 years experience; six years with inventor of Contax (Zeiss) assure 100% efficient service by highly qualified technician. Internal synchronization installed on Contax, Leica, Rollei, etc. Factory authorized Service Station for most American Manufacturers. Strauss Photo-Technical Service, 930 F St., N.W., Washington, D.C.

MISCELLANEOUS

PENNIES FOR MY THOUGHTS—You will receive abstracts from two technical papers on "The Photographic Linear Perspective" and "Radical View on Direct Color Photography", by sending self addressed stamped envelope and one dime to Ellis Camera Technique, 87 Midland Ave., Montclair, New Jersey.

Photo Book Catalog showing over 500 titles, indexed by subject, title, and author. Many described and illustrated. New edition includes latest, new titles, many unavailable elsewhere. Sent free to readers of PMI. Amphoto, 33 W. 60th St., Nw York 23, N.Y.

BUSINESS OPPORTUNITIES

STUDIO—Commercial, Portrait—Massachusetts—Completely Equipped—Largest in City—Penthouse, Roof Garden, Living Space—$6,000.00—PMI Box A-4

For detailed information from advertisers, use the convenient postage free READERS SERVICE CARD, page 59

Professional Services for Your Motion Picture
• Film Editing • Music Library (magnetic)
• Sound Effects • Original Music Scores
ROSS-GAFFNEY, Inc.
45 West 45th St., N. Y. C., N. Y. JU 2 3744
Get more information. Circle 455, page 59

HOW WOULD YOU HAVE LIGHTED THESE PICTURES?

"WITH G-E FLASHBULBS!"

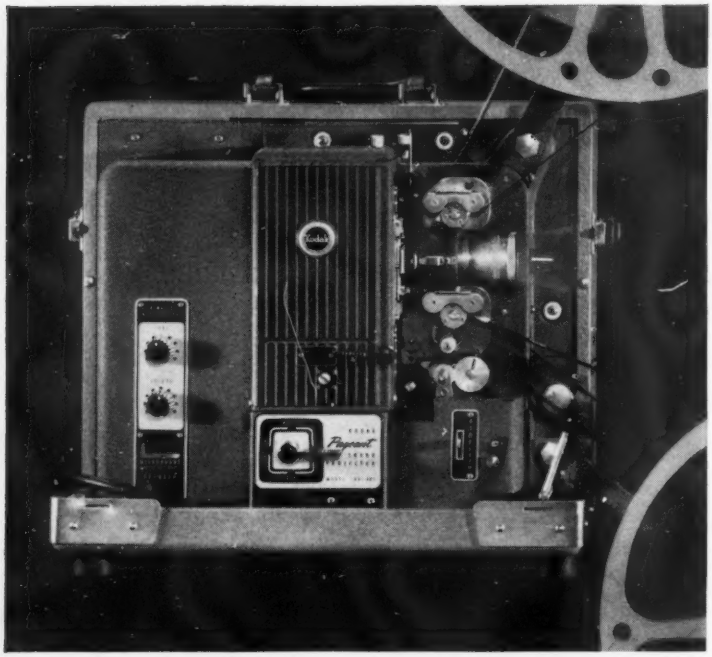
say photographers Gurley, Abercrombie, Vannuci, and Borer.

Have you solved difficult lighting problems with G-E Flashbulbs under similarly unique circumstances? If so, General Electric would like to tell your story in the professional photographers' magazines. Send your pictures with a detailed description of the job to: Photo Lamp Department, General Electric Company, Nela Park, Cleveland 12, Ohio.

GENERAL ELECTRIC

Get more information. Circle 422, page 59

KODAK REPORTS TO INDUSTRY . . .



on how to evaluate a 16mm movie projector

Because the new Kodak Pageant Sound Projector (the AV-085) invites comparison with other machines, it becomes a good yardstick for judging the values of all . . .

IT IS EASY TO RUN because reel arms are attached and fold down with belts in place. Film threading is simple. *Check for convenience.*

COMPLETELY PRELUBRICATED, requires no oiling by user, has fewer moving parts than other sound projectors, hence costs very little to service. *Check on design and durability.*

IT COSTS LESS than 16mm sound projectors with comparable performance characteristics, yet has all the essentials for brilliant, sharp pictures; clear, natural sound and all-around convenience and dependability. *Compare prices with features.*

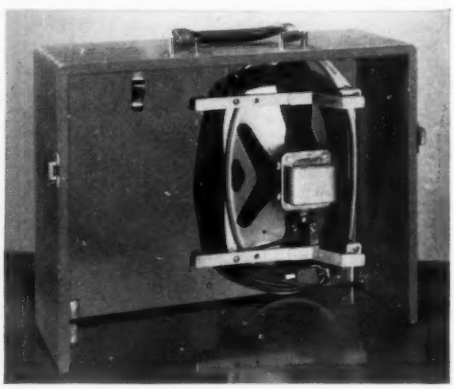
ASK YOUR KODAK AUDIO-VISUAL DEALER to demonstrate the new Pageant AV-085. He'll give you *facts* that will help *you* decide on what projector best fits your needs. No obligation.

To have the facts on file, write for a FREE copy of Bulletin V3-22, which gives full details on four Pageant Projector models.

EASTMAN KODAK COMPANY
Rochester 4, N. Y.

New low-cost Pageant Model AV-085 has powerful, sensitive new 8-watt amplifier designed around compact, rugged printed circuits.

A new, virtually *wearproof* type of pulldown mechanism operates for thousands of hours without maintenance. You'll have no problems with electrical codes either—new 3-wire power cord provides ground where required, adapts to ungrounded outlets, too.

For better listening, the speaker is housed in this baffled enclosure which assures good bass response. The speaker itself is an 11-inch *oval*—an efficient design that is more compact, yet gives you the same effective cone area as conventional 8-inch round types.

Kodak
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